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Cyclops Magnus from Amchitka, Alaska

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It is the intention of this paper to supply a small amount of data that may contribute to the clarification of the status of a cyclopoid copepod included in the viridis-vernalis group, *Cyclops magnus* Marsh 1920.

C. D. MARSH first established *C. magnus* from specimens found during the Canadian Arctic Expedition from areas in northern Canada. At a later date it was found at Churchill, Manitoba. It seems not to have been recorded from other nearby areas, perhaps due to a scarcity of collections from nearby regions and some probable misidentifications by those few investigators who have collected in those areas.

The data presented here are taken from specimens collected on the island of Amchitka in the Aleutians. About two dozen specimens were taken from a small drainage pool being fed from tundra seepage water. The water appeared to have a considerable amount of vegetational leechings, being clear, but colored. The temperature of the water was approximately 45° F. and the water was constantly moving. Data taken from these specimens follow.

The measurements of length were (mm.):

♀		♂
nonovigerous	*ovigerous*	
1.87	2.13	1.7
1.87	2.17	
1.87	2.4	
1.9	2.7 [2]	
1.96		
2.10		
2.10		
2.10		
2.47		

[1]) The collection of specimens studied here was made possible through funds provided by the Office of Naval Research.
[2]) appeared abnormally extended.

These length measurements indicate an overall greater length than has its near relative, *C. viridis*, with which it can be easily confused.

The postero-lateral angles of the dorsa were without protrusions (see figure 3).

In every specimen examined the posterior border of the abdominal segments (figure 2) was coarsely serrated except the last (figure 4), which had its posterior margin armed with small spines.

The inner margins of the furcal rami were covered with hairs (figure 4). These fine hairs were rather difficult to discern because they seemed to be finer than usual and were not as easily recognizable as are those on the lateral margins of setae. These hairs were not regularly spaced as are the secondary hairs on setae but appeared to be outgrowths without arrangement.

The relative lengths of the terminal furcal setae (innermost to outermost) were:

a)	2.1	5.7	4.7	1.2
b)	1.9	5.0	4.9	1.0
c)	2.0	7.0	5.5	1.0

The ratios of length of furcal ramus to length of innermost terminal furcal seta expressed as $\frac{\text{length of seta}}{\text{length of furca}}$ were:

1.05	1.16	1.13	1.21	1.09	1.05
1.05	1.025	1.05	1.11	1.20	1.17

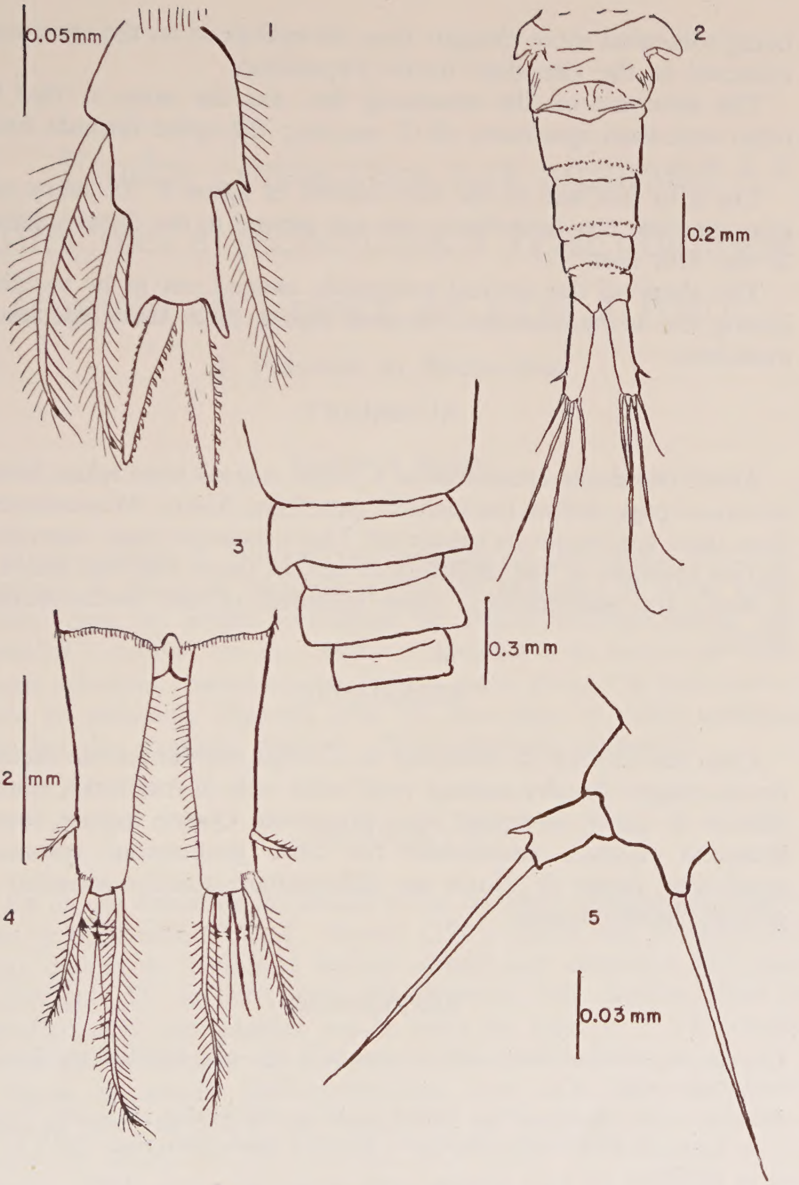
This ratio takes on a new importance in the light of these measurements. The literature indicates that this is one of the few constant differences between this species and *C. viridis* as well as *C. gigas latipes* and *C. capillatus*.

The first antennae were of 17 segments, no exceptions were noted. The esthete on the distal end of segment 12 of the antenna extended beyond the middle of segment 14 but not past its end.

The inner terminal spine of endopod 3 of the fourth swimming foot was shorter in these specimens (figure 1), having the following ratio to the outer terminal spine of the same segment:

$$\frac{\text{outer terminal spine}}{\text{inner terminal spine}} = 1.16$$

The terminal segment of the endopod of the fourth swimming foot itself had the following width: length quotient: $\frac{\text{width}}{\text{length}} = 0.437$,



EXPLANATION OF PLATE

Figure 1. Terminal segment of endopod of P_4.
Figure 2. Ventral view of abdomen.
Figure 3. First four segments of metasome.
Figure 4. Furcal rami, ventral view.
Figure 5. Fifth foot.
All drawings are from the female, *C. magnus*.

being somewhat more elongate than the endopods on the specimens collected in the Canadian Arctic Expedition.

The armature on the swimming feet was the same as that for other described specimens of *C. magnus;* the spine formula being 2, 3, 3, 3.

The fifth foot was of the form shown in figure 5. In every case examined the tiny inner spine was not jointed to the distal segment of the fifth foot.

The shape of the seminal receptable seemed not to be variable, having the anterior margin concave (figure 2) in those specimens examined.

SUMMARY

About two dozen specimens of *Cyclops magnus* were taken from a tundra seepage pool on the island of Amchitka, Alaska. Measurements from these specimens are presented. These measurements contribute further evidence of the reliability of certain spine and setal ratios as a means for differentiating some members of the viridis-vernalis group.

RIASSUNTO

Circa due dozzine di esemplari di *Cyclops magnus* furono raccolte da uno stagno (tundra seepage pool) sulla isola di Amchitka, Alaska. Misure di questi esemplari sono presentati. Queste misure contribuiscono evidenza addizionale che certe proporzioni spinose e setoli sono degne di fiducia per differenziare qualche membro del gruppo viridis-vernalis.

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Etudes consacrées aux animaux dulcicoles et recherches d'Hydrobiologie animale en France de 1945 à 1950[1])

1. Poissons et Batraciens

par

MAURICE BLANC

Notre collègue P. BOURRELLY, Assistant au Laboratoire de Cryptogamie du Muséum National d'Histoire Naturelle de Paris, ayant donné dans ce même périodique un article bibliographique très complet [2]) portant sur les travaux d'algologie et de limnologie botanique effectués récemment en France, nous avons cru faire oeuvre utile en publiant, d'accord avec lui, une mise en point analogue relative aux travaux français d'hydrobiologie animale [3]).

POISSONS [4])

En ce qui concerne les faunes et les ouvrages d'ensemble, signalons le petit manuel de P. GOSSOT (1946) relatif aux Poissons des eaux douces de France et destiné surtout aux amateurs, ainsi que le fascicule IV du Petit Atlas des Poissons (édit. Boubée) dont la parution avait été retardée par la mort du regretté J. PELLEGRIN et dont la réalisation est l'oeuvre de F. ANGEL (1946).

Parmi les articles bibliographiques, nous avons une excellente mise au point de CH. DEVILLERS (1950) sur la constitution et l'évolution du crâne chez les Poissons, un article très documenté de J. DAGET (1949) sur le rôle de la ligne latérale chez les Poissons et un

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[1]) En ce qui concerne l'année 1950, seuls les travaux publiés au début de l'année sont mentionnés dans cet article qui a été rédigé en août 1950.

[2]) BOURRELLY P. Activités algologiques et limnologiques en France pendant les années 1947-1948. *Hydrobiologia*, 1949, II (no 1), pp. 72-83.

[3]) Nous ne citons ici que les travaux sur les Poissons d'eau douce et les Poissons amphibiotiques.

travail de CH. THIBAULT et O. THIBAULT sur l'adaptation chromatique chez les Poissons (1947).

En systématique, A. BARETS utilise les caractères biométriques pour distinguer plus sûrement certains Cyprinidés très proches l'un de l'autre, tels que *Cyprinus* et *Carassius* (1947) ou *Gardonus* et *Scardinius* (1948).

Au point de vue histologique et histochimique, les travaux sont assez nombreux pendant cette période. R. ARGAUD et J. K. GAN (1945) découvrent l'existence d'ilôts pancréatiques dans la paroi même de la vésicule biliaire de l'Anguille; ces pancréas minuscules possèdent à la fois les fonctions endocrine et exocrine. L. BERNER étudie la formation et la disposition des fibres collagènes qui relient la dent à son socle chez les Téléostéens (1945), puis il décrit la structure et le développement des dents chez *Charax puntazzo* Risso (1945) et chez *Gambusia affinis* Bd. Gd. (1947). C. BIMES décrit l'hépato-pancréas des Poissons (1947). G. BOBIN (1949) précise la structure cytologique des corpuscules de Stannius (système interrénal postérieur) de l'Anguille et décrit l'évolution des lobules de la Civelle à l'adulte; il s'agit bien là d'une glande à sécrétion interne (système cortico-surrénal). G. KOBIS (1949) se livre à une étude histochimique du syncytium vitellin de l'alevin de *Salmo irideus* Gibb.; cette étude porte principalement sur le fer et sur les porphyrines ainsi que sur le stade d'apparition de l'hémoglobine. G. PALLOT, G. et J. TOURNEUX (1946) étudient les variations sexuelles de l'ilôt pancréatique des Téléostéens. Le Dr. L. THOMAS (1948) présente une thèse volumineuse et richement illustrée sur l'histopathologie des Poissons. Enfin, M. BLANC consacre une série de notes à l'étude de l'ostéogénèse chez les Téléostéens. Après avoir étudié la structure et le développement des arcs branchiaux, M. BLANC étudie en détail la structure des rayons des nageoires (1947) et interprète le tissu ostéoïde des Poissons comme un tissu osseux jeune susceptible de se transformer ensuite en tissu osseux véritable. Puis l'auteur se livre a des expériences de régénération osseuse sur des espèces variées; ces expériences de régénération donnent lieu à des observations morphologiques (1948, 1950), histologiques (1949) ou même physiologiques (1948, 1949), ces dernières étant généralement faites en collaboration avec Mme J. BUSER (1949).

En hématologie, L. ARVY et M. GABE (1948) étudient le vacuome des érythrocytes chez plusieurs Téléostéens d'eau douce. M. GABE et C. VEIL (1948) décrivent les basophiles tissulaires de l'écaille de la Carpe. Enfin, M. LAUR (1947, 1949) s'occupe particulièrement des leucocytes des Poissons.

L'embryologie des Poissons, qu'elle soit normale ou expérimen-

ale, est surtout représentée pendant cette période par CH. DEVILLERS et par TH. THOMOPOULOS. CH. DEVILLERS publie d'abord une série de notes sur la genèse de certains os du crâne chez les Salmonidés (1946, 1947 et 1948). Puis il présente une thèse très remarquée (1947) sur le rôle des organes sensoriels dans la formation du crâne dermique des Téléostéens; à l'aide d'expériences d'excisions et de greffes, l'auteur met en évidence le rôle morphogénétique des neuromastes. Après sa thèse, CH. DEVILLERS publie une autre série de notes relatives cette fois à la segmentation de l'oeuf de Truite (1948, 1950). TH. THOMOPOULOS se consacre à l'embryologie topographique de la thyroïde de *Salmo fario* L. et de *Salmo irideus* Gibb. (1948, 1950) et suggère des vues tout-à-fait nouvelles sur le développement de cette glande qui, chez les Poissons, est fort aberrante.

Au point de vue de la reproduction des Poissons, citons un article de L. BERTIN (1947) sur les nids des Poissons, un article de Y. FRANÇOIS (1946) sur les principaux aspects de la reproduction chez les Poissons et deux notes de G. BRESSE (1946) sur la reproduction chez les Bouvières. L. GALLIEN publie plusieurs notes (1945, 1946 et 1947) sur la reproduction et la génétique de *Lebistes reticulatus* Peters.

En physiologie, les travaux sont nombreux. D. ABBE—FESSARD, C. CHAGAS, A. COUCEIRO et A. FESSARD (1948) étudient la production d'électricité chez les Gymnotes. Mme J. BUSER, soit seule (1948, 1950), soit en collaboration avec M. BLANC (1949), étudie la biochimie et la physiologie de l'ostéogénèse chez les Téléostéens. P. BUSER (1949) publie une note de physiologie nerveuse sur l'excitation du nerf optique chez le Poisson-Chat et compare cette expérience avec une expérience analogue faite chez la Grenouille, R. G. BUSNEL, A. DRILHON et A. RAFFY étudient la physiologie générale des Poissons de la famille des Salmonidés (1946). M. LAFFON (1947) recherche la façon dont les réserves vitellines sont utilisées au cours du développement chez les alevins de Truite. R. LHOTTE (1945) publie une note relative à l'influence de la salinité sur le fonctionnement du coeur chez la Civelle. CH. THIBAULT étudie de façon très approfondie le comportement des Poissons, et plus particulièrement de la Carpe, vis à vis de la lumière (1946, 1947, et 1949) et leurs réactions aux variations d'éclairement. V. VILTER publie une série de notes sur divers aspects de la métamorphose chez l'Anguille; il montre notamment que l'hypophyse commande les modifications pigmentaires accompagnant la métamorphose (1945), que la brusque augmentation de la croissance stomacale des Civelles est due au passage dans l'eau douce (1945) et que la thyroxine ne semble pas intervenir sur le déclenchement de la métamorphose de l'Anguille contrairement à ce qui se passe chez les Batraciens (1946). Pour terminer ce

paragraphe sur la physiologie ichthyologique, il faut faire une mention spéciale des travaux de M. FONTAINE qui, avec l'aide de ses élèves, notamment O. CALLAMAND, J. LELOUP et M. OLIVEREAU, consacre une grande partie de son activité depuis plusieurs années à l'étude du problème des migrations chez les Poissons et notamment à l'étude du rôle des différents facteurs, externes et internes, dans ces migrations compliquées (voir nombreuses références de 1945 à 1950).

Mais les Poissons des eaux douces métropolitaines ne sont pas les seuls a être étudiés par les Français, car depuis quelque temps les espèces exotiques d'eau douce sont également à l'honneur. C'est ainsi que L. BERTIN (1948) consacre un article important à la biogéographie des Poissons d'eau douce de Madagascar, et que son assistante, R. ESTEVE, publie une note sur les barbeaux marocains (1947) et une autre note sur les Poissons du Sahara Central (1949). En Afrique Occidentale, l'étude des poissons d'eau douce est principalement entreprise par l'Institut Français d'Afrique Noire (directeur TH. MONOD) qui possède, d'une part un laboratoire lagunaire à Abidjan, Côte d'Ivoire (directeur J. L. TOURNIER), avec un laboratoire flottant automoteur, le Baléo II, et d'autre part une Station hydrobiologique en construction, à Diafarabé sur le Niger, Soudan (directeur: J. DAGET), avec des bassins d'élevage et un chaland-laboratoire à moteur: le Tilapia. Alors qu'Abidjan a consacré jusqu'ici son activité principale aux problèmes hydrologiques, Diafarabé a pour objectif essentiel l'étude des poissons (faunistique, biologie, développement, biométrie, scalimétrie, ichthyologie appliquée). TH. MONOD consacre de plus un numéro entier de *Cybium* (no 4, 1949) aux travaux sur les eaux douces africaines et publie (1945, 1947, 1949 et 1950), ainsi que J. DAGET (1948, 1949 et 1950), plusieurs notes sur les Poissons de ces régions. J. DAGET publie d'autre part une thèse importante sur les Polyptéridés (1949). Rappelons également que P. BUDKER, dans son livre sur „la vie des requins" (1947) consacre un important chapitre aux requins d'eau douce, et que J. CHAUX se spécialise dans l'étude des représentants de la famille des Siluridés (1948, 1949). Enfin, pour finir, signalons la belle remise en marche, grâce aux efforts de G. GOUSSEF, de l'Aquarium du Musée des Colonies dont l'activité avait été presqu'entièrement stoppée par suite de la guerre.

Avant d'en terminer avec les études sur les Poissons d'eau douce, il nous reste à évoquer les travaux proprement piscicoles. Ces travaux, qui sont poursuivis dans plusieurs centres, ont été, pendant la période considérée, l'objet d'encouragements particulièrement attentifs de la part de l'Administration des Eaux et Forêts et des services qui en dépendent ou collaborent avec elle.

L'élevage des Salmonidés constitue une des principales branches de la pisciculture en France. R. LIGNIERES et H. HOESTLANDT (1949, 1950) examinent le problème délicat de l'alimentation artificielle des jeunes alevins de *Salmo irideus* Gibb. R. TAGAND, H. HOESTLANDT et L. EYRAUD (1947) étudient les principaux facteurs de croissance de cette même espèce. Enfin, R. VIBERT s'occupe particulièrement de la répartition des Truites et des Saumons dans les conditions naturelles (1945, 1948, 1949 et 1950).

L'élevage des Cyprinidés, et principalement des Carpes, donne lieu également à des recherches importantes. R. CHIMITS et S. KRECZMER (1946, 1947) s'occupent de l'élevage des alevins de Carpe dans différentes conditions et M. LEFEVRE (1948) étudie la nutrition de la Carpe en étang.

L'élevage des alevins de Brochet ainsi que le repeuplement des eaux douces en Brochets commencent à faire l'objet de recherches assez approfondies de la part de quelques auteurs, principalement de P. CHIMITS (1947) et de J. PORTAL (1947).

L'Alose du Rhône constitue un matériel précieux abondamment utilisé par C. GALLOIS (1946, 1947) qui réussit même à pratiquer la fécondation chez cette espèce, de même que l'abbé H. HOESTLANDT (1947, 1948). Le développement de la Perche est étudié par J. ARLET (1945). Enfin P. CHIMITS (1947), déjà cité, s'occupe également de l'acclimatation de *Gambusia holbrooki* dans la région des Landes.

Pour terminer ce chapitre, signalons le petit livre de M. BOUCHER (1948) intitulé "l'aquarium équilibré", dans lequel les amateurs aquariophiles trouveront tous les renseignements techniques nécessaires sur l'élevage en appartement des Poissons d'eau froide et d'eau chaude.

BATRACIENS

En ce qui concerne la systématique des Batraciens, signalons principalement les travaux de F. ANGEL et ceux de J. GUIBÉ. F. ANGEL publie le "Petit Atlas des Amphibiens et des Reptiles", en deux fascicules (1946), puis la Faune de France des Reptiles et des Batraciens (1946) et enfin un traité plus général intitulé "Vie et Moeurs des Amphibiens" (1947). D'autre part, il publie en collaboration avec M. LAMOTTE une note sur la biologie d'un Crapaud vivipare du genre *Nectophrynoïdes.* Avec J. GUIBE il publie quelques notes de pure systématique (1945). J. GUIBE publie en outre seul plusieurs notes de systématique (1945, 1947), ainsi qu'un court article sur la biogéographie des Batraciens de Madagascar (1948). Dans le même ordre d'idées, P. REY démontre l'existence de races

géographiques chez *Bufo vulgaris* Laur. (1946) et L. VALLEE décrit les races sexuelles françaises de *Rana temporaria* L. (1947).

Du point de vue anatomique et histologique, signalons le travail de R. COUTEAUX (1945) sur les rapports entre nerfs et muscles chez la Grenouille, et celui de F. MARCEAU (1946) sur la terminaison du pneumogastrique dans le muscle cardiaque de la Grenouille et du Crapaud. M. LAUR (1948) présente une note sur l'hématologie du Triton.

L'embryologie des Batraciens donne lieu à des travaux importants. Ce sont en effet ceux des Vertébrés dont les oeufs et les embryons se prêtent le mieux à l'expérimentation. P. ANCEL et P. VINTEMBERGER, dans une série de notes (1947, 1948 et 1949), étudient la segmentation de l'oeuf. D. BOGORAZE (1946) se livre à des recherches sur le système nerveux des têtards d'Anoures. R. CAMBAR publie une douzaine de notes (1947, 1948 et 1949) sur le système rénal; il étudie tour à tour la formation du pronéphros, puis du mésonéphros chez les Anoures et recherche les éléments inducteurs du système rénal. P. HATT (1945) étudie la blastotomie chez le Triton. R. LALLIER (1949) étudie l'action de différentes substances sur la gastrulation. J. ROSTAND, après avoir examiné en collaboration avec H. MUGARD (1946) l'action du gaz carbonique sur les oeufs de Batraciens, cherche à perturber le processus normal du développement de l'oeuf (1946, 1947, 1948 et 1949). P. SENTEIN (1948, 1949) s'occupe de la mitose et de l'action des substances antimitotiques sur l'oeuf de Batraciens. R. STOLL (1946) décrit les premiers stades de la segmentation de l'oeuf chez *Bufo vulgaris* Laur. Enfin, J. A. THOMAS, J. ROSTAND et J. GREGOIRE (1946) mettent en évidence l'action inhibitrice de la ribonucléase sur la segmentation des oeufs de Grenouille.

En Physiologie, les travaux sont nombreux également, la Grenouille étant, comme chacun sait, un parfait animal de laboratoire. L. ARVY, J. A. BOIFFARD et M. GABE (1947) étudient l'action des rayons X sur l'hypophyse de *Rana temporaria* L., puis les modifications hématologiques provoquées sur les sujets ainsi irradiés. L. ARVY décrit un dimorphisme sexuel sanguin chez *Rana temporaria* L. et chez *Bufo vulgaris* Laur. (1947), puis étudie l'action de la glande thyroïde sur l'hématopoïèse chez la Grenouille (1949, 1950). C. CHAMPY et M. DEMAY recherchent le rôle du système nerveux dans le développement des callosités (1949). Les mêmes auteurs décrivent les dispositifs d'adaptation au saut chez les Grenouilles (1949), J. CREZE (1949) présente deux petites notes sur le déterminisme de la ponte chez *Xenophus laevis*. M. DELSOL (1950) cherche à évaluer l'activité de la thyroïde chez les Têtards de Discoglosses à l'aide du thiouracile. M. GABE (1946) se livre à des expériences d'autogreffe hépatique sur la grenouille d'hiver. L. GALLIEN étu-

die la callosité de *Xenopus laevis* (1947), puis l'action de la prégnéninolone comme antithyroïdien chez le têtard de Discoglosse (1949) et l'action de l'éthinyl-testostérone sur le développement de *Rana temporaria* L. (1949). C. Gauthier dans une courte note (1946) étudie la naissance du réflexe amoteur chez le Crapaud. J. Jolly étudie la disposition et la formation du système lymphatique des Batraciens (1945, 1946). Ce même auteur étudie également quelques phénomènes de régénération (1946, 1949) chez ces animaux. M. Lecamp étudie les phénomènes de régénération chez les Batraciens, notamment l'action de diverses substances sur la régénération, ainsi que la culture des tissus de régénération in vitro (1947, 1948, 1949). J. Lhoste et P. Roth (1946) étudient le développement des oeufs de Grenouille. D. Picard et H. Tuchmann—Duplessis (1946) étudient le rôle du système réticulo-endothélial chez le Triton alpestre. A. Raffy donne une revue intéressante et documentée sur la physiologie des animaux amphibies; des exemples pris chez les Batraciens y sont souvent cités. P. Roth publie une thèse (1945) et de nombreuses notes (1946, 1947, 1948 et 1950) sur l'action de diverses substances hormonales et notamment de la thyroxine sur la métamorphose des Batraciens. A. Serfaty (1946) donne une courte note sur la résistance des Grenouilles à l'asphyxie. F. Stutinsky (1945, 1946 et 1947) étudie de façon suivie la mélanocinèse des Batracièns et l'action du lobe intermédiaire de l'hypophyse sur celle-ci. J. A. Thomas et I. Borderioux (1947, 1948) réalisent de belles expériences de survie avec des fragments d'organes de Triton conservés dans un milieu spécialement préparé. H. Tuchmann—Duplessis travaille sur les glandes endocrines (thyroïde, hypophyse et gonades) du Triton, étudie leurs variations saisonnières, leurs interactions et leur influence sur la régénération (1945, 1946, 1948 et 1949). Enfin, J. Tusques étudie le rôle de la thyroxine sur le développement des têtards (1949).

Pour terminer ce chapitre, il nous reste à citer quelques publications à tendance écologique, telles que celle de E. Brumpt (1945) à propos de l'utilisation de *Xenopus laevis* dans la lutte contre les larves de Moustiques, celle de Y. Moron (1947) sur l'écologie, la biologie et l'anatomie de *Xenopus tropicalis* rapporté de Haute-Guinée par M. Lamotte, et celle de R. Paulian et A. Vilardebo (1946) sur l'alimentation des Batraciens en Basse Côte d'Ivoire.

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ADDENDUM

Travaux parus en 1950.

POISSONS[1])

En systématique, L. BERTIN publie un mémoire sur la curieuse collection de Poissons en herbier du naturaliste MICHEL ADANSON et sur la façon dont celui-ci concevait la classification ichthyologique.

En ce qui concerne les travaux d'ordre physiologique, nous pouvons signaler plusieurs notes ou articles de M. FONTAINE et de ses collaborateurs sur le Saumon et les principales variations biochimiques observées chez cet animal aux différentes périodes de sa vie. J. BARON publie plusieurs notes sur l'étude de l'équilibre chez les Poissons et plus particulièrement sur le rôle des muscles moteurs oculaires dans l'équilibration. L'abbé H. HOESTLANDT effectue, en collaboration avec H. VINCENT, des essais relatifs à l'action de l'acide 2—4 dichlorophénoxyacétique sur les Poissons et les Batraciens. A. JULLIEN, P. LAURENT et J. RIPPLINGER (1950) effectuent des dosages d'acétylcholine chez plusieurs Poissons d'eau douce. Ils réalisent chez les Mollusques et les Poissons la préparation sur le vivant de la branche cardiaque du pneumogastrique et pratiquent des exitations tout en contrôlant le rythme du coeur par des enregistrements graphiques.

En histologie, TH. THOMOPOULOS étudie la thyroïde de *Gymnarchus niloticus* Cuv. et fait des comparaisons avec les Sélaciens et les Salmonidés.

Au point de vue de la reproduction, G. BRESSE donne deux nouvelles notes sur la curieuse reproduction des Bouvières et le rôle des Moules d'eau douce au cours de celle-ci.

Les espèces exotiques donnent lieu également à des travaux intéressants. TH. MONOD publie de nouvelles observations sur les Poissons d'eau douce de l'A.O.F., tandis que J. DAGET poursuit ses travaux à la Station Hydrobiologique de Diafarabé. D'autre part, J. DURAND présente un important mémoire sur l'hématologie des Poissons d'Indochine. Enfin, J. PUYO fait paraître une faune générale des Poissons de la Guyane française, dont il rassemblait les éléments depuis de nombreuses années.

Pour terminer, signalons qu'au point de vue proprement piscicole, R. VIBERT donne une nouvelle étude du Saumon de l'Adour, tandis que J. WURTZ-ARLET présente quelques observations sur la Vandoise.

[1]) Nous envisageons uniquement les Poissons d'eau douce ou amphibiotiques.

BATRACIENS

En systématique, L Bertin assure la publication à titre posthume de deux notes de F. Angel, décédé dans l'année; l'une de ces notes concerne les Batraciens de Madagascar et l'autre ceux des Monts Nimba (Guinée). D'autre part, J. Guibe étudie lui aussi les Batraciens de Madagascar, soit en collaboration avec J. Millot, soit seul.

En ce qui concerne les travaux de physiologie, L. Gallien, dans un important mémoire, étudie la différenciation du sexe chez le Discoglosse et la Grenouille rousse, et P. Roth continue la série de ses publications relatives à l'action des hormones sur le développement et les métamorphoses de l'Axolotl. Rappelons que H. Hoestlandt et H. Vincent essayent l'action de l'acide 2—4 dichlorophénoxyacétique sur les Batraciens Anoures en même temps que sur les Poissons, ainsi que nous l'avons signalé plus haut. Enfin H. Tuchmann—Duplessis étudie l'action inhibitrice des sels de béryllium sur les phénomènes de régénération chez différentes espèces de Tritons.

Au point de vue cytologique, L. Gallien et H. Mugard font une démonstration technique d'imprégnation argentique et de coloration au Feulgen de l'extrémité caudale des larves de Pleurodèles hétéroploïdes.

Enfin, en neurologie, M. Jacquot publie deux notes sur le développement cérébral des Batraciens Urodèles.

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Taxonomy of the nymphs of the British species of Leptophlebiidae (Ephem.)

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(with 4 figures)

As in previous studies (see Macan 1951 for references), specific distinction has been established on cast skins identified from the adults that emerged from them. Points of difference having been found in this way, it has been possible to base the descriptions on both cast skins and whole nymphs.

There are six British species in this family: two in the genus *Leptophlebia*, three in the genus *Paraleptophlebia*, and one in the genus *Habrophlebia*.

The nymphs of all have been described before, but critical comparison of the species has revealed differences not noticed previously and shown that some of the distinctions used hitherto are less reliable than has been thought.

Separation of the genera

Habrophlebia is distinguished at once by its gills, each of which has several filaments (fig. 3F), and there are other points of difference, which have been mentioned in the description of *H. fusca*. *Leptophlebia* and *Paraleptophlebia* are also distinguished by the gills, though otherwise they resemble each other closely. The gills of *Leptophlebia* are swollen at the base (fig. 3M, V), those of *Paraleptophlebia* are more or less straight-sided (fig. 3S, T). In small specimens of *Leptophlebia*, however, the basal swelling of the gill is very slight and in specimens 3 mm. long (the smallest I have seen)

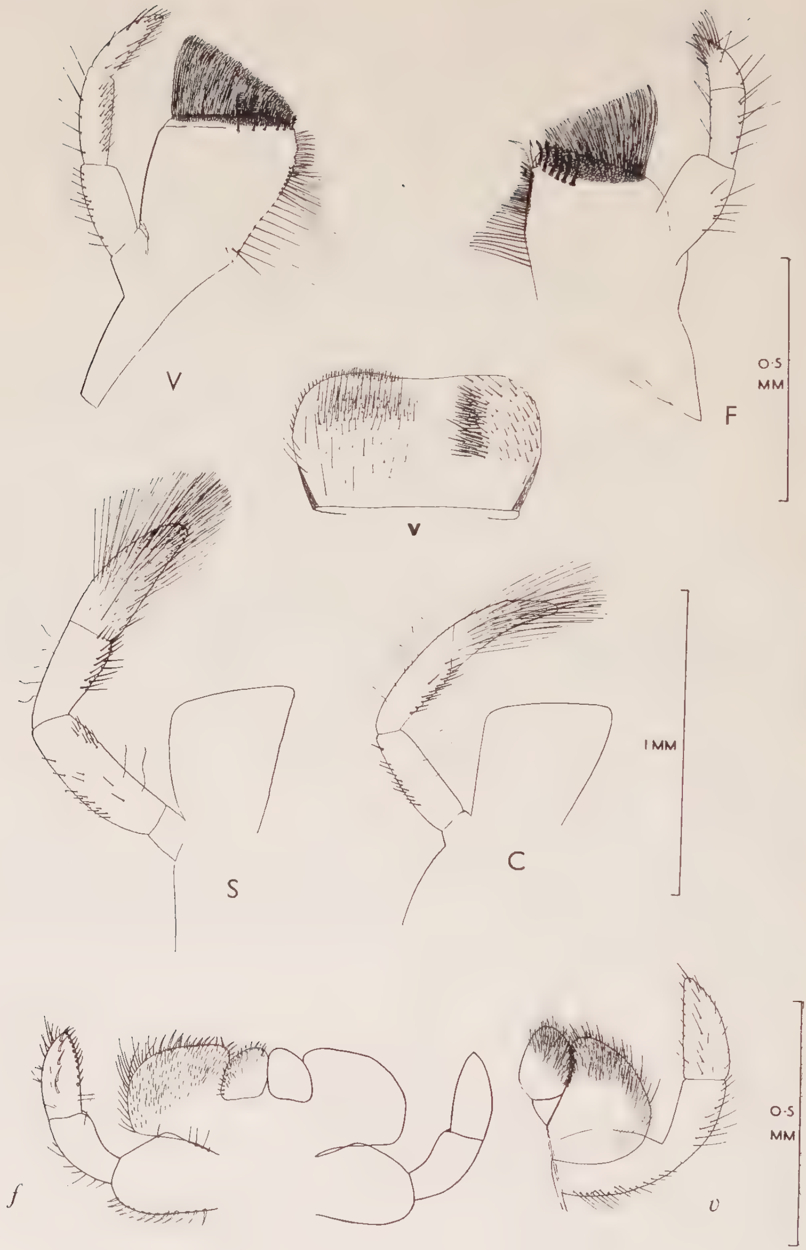

Fig. 1
V, F maxilla of *Leptophlebia vespertina* and *Habrophlebia fusca*. **V** labrum of *L. vespertina*. S, C maxillary palp and outline of maxilla of *Paraleptophlebia submarginata* and *P. cincta*. f, v labium of *H. fusca* and *L. vespertina*.

it is easily overlooked unless the gill is examined carefully. The maxillary palps of *Paraleptophlebia* (fig. 1S, C) are longer than those of *Leptophlebia* (fig. I V). Specimens of *Paraleptophlebia submarginata* 3 mm. long (small specimens of the other two species in this genus were not available) are more easily distinguished from specimens of *Leptophlebia* of the same size by the maxillary palps than by the gills.

Descriptions and comparisons of the species

Leptophlebia vespertina (Linnaeus)

Previously described by Lestage 1917 (p. 330) and 1919 (p. 120 and fig. 7).

Material: Blelham Beck, WL, 2 cast skins; Cunsey Beck, WL, 1 cast skin; Nor Moss Beck, WL, 6 cast skins; Waterston Moss, WL, 4 cast skins; Windermere, WL, 1 cast skin; Wise Een Tarn, WL, 2 cast skins; Wray Mires Tarn, WL, 3 cast skins; Buttermere, CU, 2 cast skins; Wicken Fen, CB, 6 whole nymphs; Ditchend Brook, SH, 6 whole nymphs; Dockens Water, SH, 1 cast skin.

Markings: The nymph is brown. On each abdominal tergite there is a pair of triangular light dots near the proximal margin, and larger less distinct light areas near the sides. This pattern is rather constant, though the degree of contrast between the light and dark parts varies considerably.

Lengths: 7.0—10.0 mm.

Mouthparts, legs, and *gills* are illustrated in figs. 1, 2, 3 and 4. It will be more convenient to discuss them under the next species.

Ecology: In the Lake District (WL and CU) this species abounds in the more sheltered parts of lakes (Moon 1936) and in tarns (Macan 1949) and occurs also in slowly flowing streams where there is vegetation. In southern Hampshire (SH), nymphs were found in streams draining the sandy base-deficient soils of the New Forest, but not in the calcareous waters of the River Avon and its tributaries (Macan, T.T. and Z. 1939). The species was found in ditches among the sedge at Wicken Fen, a region of calcareous peat.

Leptophlebia marginata (Linnaeus)

Previously described by Lestage (1917, p. 328 and fig. 25).

Material: Nor Moss Beck, WL, 1 cast skin; Rather Heath 6, WL, 3 cast skins; Three Dubs Tarn, WL, 1 cast skin; Cooper's Bottom, SH, 4 whole nymphs; Loch of Lauriston, 2 whole nymphs. (The last place is presumably in Scotland, but there is no other data on the label and I cannot remember who was kind enough to send these specimens).

Markings: The pattern on the abdominal tergites is basically the same as that of *L. vespertina*, but more variable. The lateral pale marks are commonly smaller, and there is often a distal median light dot, line, or triangular mark.

Lengths: 10.5—11.5 mm.

The mouthparts are identical with those of *L. vespertina* apart from some small details of trichiation: the hairs on the front margin of the

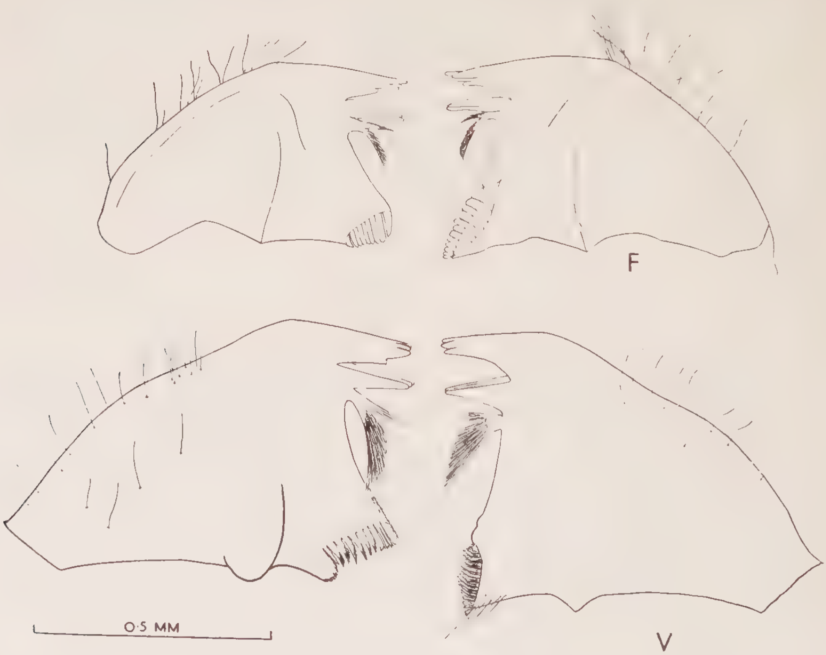

Fig. 2.

Mandibles of *Habrophlebia fusca* (F) and *Leptophlebia vespertina* (V).

labrum and at the tip of the labial palp are somewhat longer, and more of the paraglossae is covered with hairs.

Gills: The blade of each gill, except the first, is broad and ovate, sweeping round to meet the filament somewhat abruptly (fig. 3M), whereas that of *L. vespertina* tapers gradually into the filament (fig. 3V). The filament of *L. marginata* is shorter than that of *L. vespertina*. This difference in gill-shape has hitherto been deemed sufficient to distinguish the species (eg. Schoenemund 1930, Ulmer 1943). The shape of the gill, however, depends on its size, and the typical ovate shape of *L. marginata* is found only on full-grown nymphs; moreover, the length of the filament is variable. A specimen of *L. marginata* 8 mm. long has gills very like those of *L. vespertina* of the same size, and the two cannot be separated on this character.

Legs: The underside of the fore femora of *L. vespertina* (fig. 4**V**) is beset with spines most of which are complex and of the type shown in fig. 4v. They are fairly obvious under the low power of the compound microscope (x 165). Some of them have more lateral branches than those illustrated, and a few have numerous tiny lateral branches that are no more than hairs.

The corresponding spines of *L. marginata* appear simple under low power magnification, but under high power (x 750) are seen to be fringed with tiny hairs (fig. 4m). This is the most certain distinction between the species.

On a specimen of *L. vespertina* 3 mm. long, most of the spines had more lateral branches than those of bigger specimens, and there were more spines bordered with hairs, but it was just possible to make out with low power magnification that some of the spines were complex. The smallest specimen of *L. marginata* seen was 5.2 mm. long. The lateral hairs on the spines were rather more conspicuous than those of larger specimens, but they were still detectable only under high power magnification.

The middle legs of the two species do not differ significantly. The upper surface of the tibia of *L. vespertina* usually has a few spines on it, that of *L. marginata* is usually bare except for some long hairs. The tibiae of the hind legs of the two are similar, with fairly numerous spines along the upper surface, but the tarsi differ. Those of *L. marginata* usually have a number of spines along the upper surface (fig. 4**M**), those of *L. vespertina* none or only a few. Unfortunately this is not invariable, and *L. vespertina* may bear many spines.

The teeth approach nearer the tip of the claw in *L. vespertina* (fig. 4V) than in *L. marginata* (fig. 4M). This difference is constant on the specimens that have been examined and, with a little practice, affords a satisfactory means of distinguishing the two species.

Ecology: This species has generally been found with *L. vespertina*, though in smaller numbers.

Paraleptophlebia submarginata (Stephens)

Material: Nor Moss Beck, WL, 3 cast skins and 2 whole nymphs; R. Rawthey, MY, 4 cast skins and 1 whole nymph; R. Ribble, MY, 1 cast skin; Teal Burn, KF, 3 whole nymphs; Daggons Brook, SH, 2 whole nymphs.

I am indebted to Mr D. Scott of the Scottish Brown Trout Research Laboraty for the specimens from Teal Burn.

Markings: Some specimens have abdominal markings similar to those of *L. vespertina;* others are uniformly brown. Some have a pale transverse line and a U-shaped mark at the distal end of the segments.

Lengths: 8.0—11.5 mm.

The mouthparts are like those of *L. vespertina*, except that the last segment of both sets of palps bears long fine hairs, those on the maxillary palp being particularly long and dense. The whole palp is of unusual length (fig. 1S).

Gills: There is a progressive but slight diminution in the size of the gills from the middle to the ends of the series, except that the first is distinctly smaller than the rest, usually about half the size (fig. 3S).

Legs: Spines are absent from the upper surface of all the tarsi and from the fore and mid-tibiae.

The spines on the femora occur in three irregular rows, along the top, along the middle, and along the bottom (the leg being in the position shown in fig. 4). On the fore femora most of the spines are fairly long, those in the middle are finer than the others, and all are tapering and pointed except a few at the distal end of the upper row. These taper but are blunt at the tip. The mid femur is similar but there are more blunt spines, most of those in the middle row being blunt. The hind femur has characteristic spines. All those of the middle and bottom rows are blunt and parallel-sided, and some are short (fig. 4s).

The teeth extend a little more than half-way along the claws.

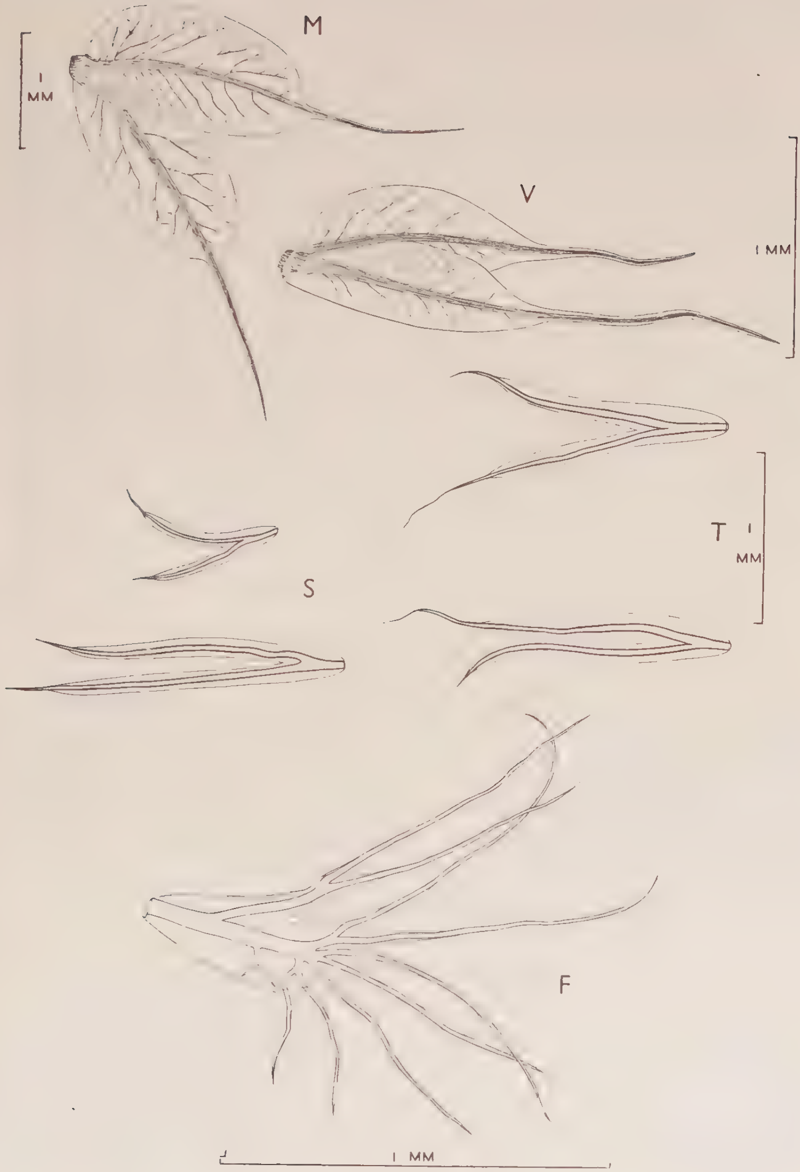

Fig. 3.

M, V 4th gills of *Leptophlebia marginata* and *vespertina*. S, T 1st and 2nd gills of *Paraleptophlebia submarginata* and *tumida*. F 4th gill of *Habrophlebia fusca*.

Ecology: This species occurs in sluggish streams and occasionally in rapid stony ones and in rivers.

Paraleptophlebia tumida Bengtsson

Previously described and figured by Ulmer (1943, p. 336, figs. 1—10).

Material: Allen R., SH, 1 cast skin and 11 whole nymphs; R. Till, SW, 1 cast skin and 7 whole nymphs.

Lengths: 8—9 mm.

Distinction from P. submarginata: 1. The gills diminish slightly and regularly in size from the middle outwards, and the first gill is not distinctly smaller than the rest (fig. 3T).

2. The maxillary palp is not as long, and the hairs on its last segment are fewer and shorter (fig. 1C).

3. All the spines on the hind femora are pointed, and none is very short (fig. 4t).

4. There are fewer fine hairs on the palps of the labium, and the glossae are more pointed.

Ecology: Allen River and River Till are streams in chalk-down valleys. They flow with moderate speed over stony beds and are densely overgrown with vegetation. Surface water probably disappears every summer. In these two streams, *P. tumida* was abundant and no other Ephemeroptera were found (T.T. and Z. Macan 1940). The species has never been recorded anywhere else in Britain. (There is an error in the paper referred to. Allen River was dry on 6:vi, not 6:v as shown in table 1 on p. 59).

Paraleptophlebia cincta (Retzius)

Previously described and figured by Eaton (1888, pl. 32) and Lestage (1919, p. 342 and fig. 27).

Material: R. Wharfe, MY, 1 cast skin; R. Kent, WL, 1 whole nymph.

Length: 7.5 mm.

Distinction from foregoing species: This species resembles *P. tumida* closely, and both differ from *P. submarginata* in the same way,

though, as will be seen presently, the femoral spines of the two are not identical.

P. cincta and *P. tumida* can be separated on the following characters:

1. The spines of the middle and lower rows on the hind femora of *P. cincta* are intermediate in character between those of the other two species; they taper like those of *P. tumida*, but are blunt-ended like those of *P. submarginata* (fig. 4c).

2. The teeth do not extend far beyond the middle of the claw of *P. cincta* (fig. 4C), those of *P. tumida* reach nearly three-quarters of the way to the tip (fig. 4T). The number of teeth is unexpectedly variable and not always higher on *P. tumida*, as might be expected. Six specimens of *P. tumida* had respectively 22, 22, 27, 27, 27, and 28 teeth on one of the hind claws; both specimens of *P. cincta* had 21.

3. The maxillary palp of *P. cincta* is slightly longer.

Ecology: This species appears to be fairly widespread but nowhere abundant. In addition to my own two records, I have nine kindly supplied by Mr D. E. Kimmins; all are from rivers.

Habrophlebia fusca (Curtis)

Previously described and figured by Eaton (1888, pl. 36) and Lestage (1919, p. 348 and fig. 30).

Material: Hog House Beck, WL, 1 cast skin; R. Ribble, MY, 3 cast skins; Daggons Brook, SH, 4 whole nymphs.

Markings: The abdominal tergites are uniformly pigmented.

Lengths: 6.5—8.0 mm.

The mouthparts are of the same type as those of the other two genera, but differ in detail: the front margin of the labrum is more deeply indented; the mandibles are more rounded along the outside (fig. 2F); the maxilla is shorter, and the short conical last segment of its palp is characteristic (fig. 1F); the labial palps are shorter (fig. 1f).

Gills: Each is divided into two lobes which bear between them some 5 to 12 filaments according to their position in the series, those in the middle being the most richly provided. No other British Ephemeropteron nymph has gills like this.

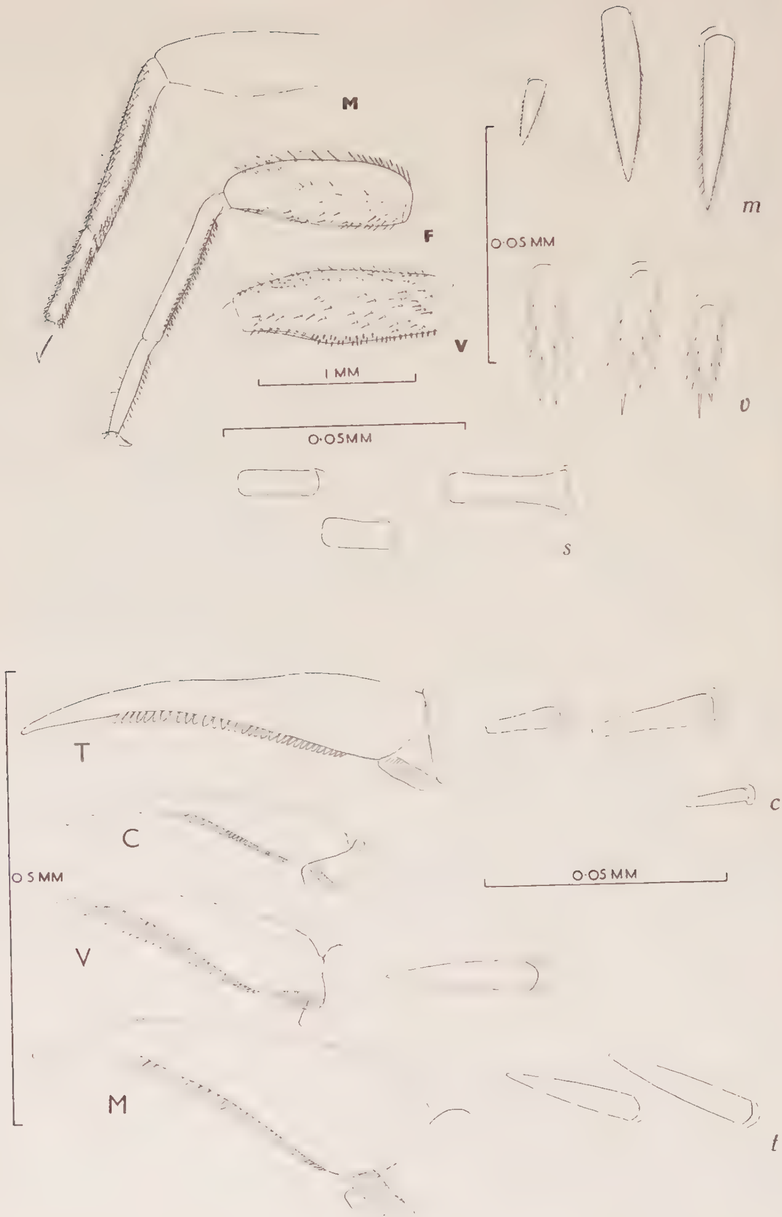

Fig. 4.

M hind-leg of *Leptophlebia marginata* showing spines on tibia and tarsus; **F** fore-leg of *Habrophlebia fusca;* **V** fore-femur of *Leptophlebia vespertina.* m, v, spines from underside of fore femur of *L. marginata* and *vespertina;* s, c, t spines from underside of hind femur of *Paraleptophlebia submarginata, cincta, tumida.* T, C, V, M hind claws of *P. tumida, P. cincta, L. vespertina, L. marginata.*

The legs are less thickly beset with spines than those of the other species and spines are absent from the upper surface of all tibiae and tarsi (fig. **4F**). There are about 12 teeth on the hind claws.

Ecology: Hog House Beck, in the Lake District, is a slow stream flowing over a sandy bottom with a few stones and some tufts of vegetation. *Habrophlebia* nymphs are quite common on the stones but none have been taken by sweeping through the weeds with a net. Miss Hampshire found numbers of nymphs on stones in a similar stream in South Lancashire (SL); she did not collect in the vegetation. Daggons Brook, in the south of England, is also a small slow stream with a sandy bottom in which occasional patches of vegetation are rooted. There are no stones but packets of dead leaves occur at intervals. Nymphs were abundant in these packets of dead leaves but not in the vegetation. *H. fusca* has been taken in various other streams and some rivers, but these were the only places where it was numerous.

CB = Cambridgeshire, CU = Cumberland, MY = Mid Yorkshire, SH = South Hampshire, WL = Westmorland (England), KF = Kinross and Fifeshire (Scotland).

Acknowledgments

It is a pleasure to acknowledge my indebtedness to Mr D. E. Kimmins who has identified many of the adults and put the records of the British Museum freely at my disposal; to my assistant, Miss Jean Hampshire, who has drawn some of the figures and helped with all aspects of the work; and to Dr J. Senez who has translated the key into French.

Key

1. Gills with several branches (fig. 3F) .... *Habrophlebia fusca*

   Gills with two branches (fig. 3M, V, S, T) 2

2. Gills (except the first) expanded at the base (fig. 3M, V) *Leptophlebia* 3

- Gills straight-sided (fig. 3S, T) .... *Paraleptophlebia* 4

3. Compound spines on the underside of the fore femora (fig. 4v); teeth extending about five-sixths of the way

along the claw (fig. 4V); blade of gills tapering and merging gently into the filament (fig. 3V) .... *L. vespertina*

- Finely frayed spines, appearing simple except under high power magnification, on the underside of the fore femora (fig. 4m); teeth extending about three-quarters of the way along the claw (fig. 4M); blade of gills strongly rounded, meeting the filament abruptly (fig. 3M) (only in full-grown specimens) .... *L. marginata*

4. First gill distinctly smaller than all the rest (fig. 3S); spines on underside of hind femora parallel-sided and blunt at the tip, many of them short (fig. 4s); maxillary palps large, the last segment densely covered with long fine hairs (fig. 1S) .... *P. submarginata*

- First gill only slightly, if at all, smaller than the others (fig. 3T); spines on underside of hind femora tapering (fig. 4c, t); maxillary palps smaller, the last segment less densely covered with long fine hairs (fig. 1C) 5

5. Spines on underside of hind femora pointed, rather few of them short (fig. 4t); teeth extending nearly three-quarters of the way along the claw (fig. 4T) .... *P. tumida*

- Spines on underside of hind femora tapering but blunt at the tip (fig. 4c); teeth not extending far beyond the middle of the claw (fig. 4C) .... *P. cincta*

Tableau synoptique

1. Branchies multi-ramifiées (fig. 3F) ...... *Habrophlebia fusca*

- Branchies bifides (fig. 3M, V, S, T) 2

2. Branchies renflées à la base (sauf la première) (fig. 3M, V) *Leptophlebia* 3

- Branchies à bords rectilignes (fig. 3S, T) *Paraleptophlebia* 4

3. Epines très dentelées (fig. 4v) sur la face inférieure des fémurs antérieurs; la rangée de dents s'étend sur les 5/6 environ de la griffe (fig. 4V); le renflement basal de la

branchie se rétréçit progressivement vers l'extrémité (fig. 3V) .... *L. vespertina*

- Epines simples (avec fines dentelures seulement visible aux forts grossissements) (fig. 4m) sur la face inférieure des fémurs antérieurs; la rangée de dents s'étend sur les 3/4 environ de la griffe (fig. 4M); le renflement basal des branchies est de forme ovale et se termine brusquement (fig. 3M) (ce caractère n'existe que sur les nymphes ayant atteint leur complet developpement) .... *L. marginata*

4. Première branchie beaucoup plus courte que les autres (fig. 3S); sur la face inférieure des fémurs postérieurs, épines à bords rectilignes et à terminaison brusque, souvent courtes (fig. 4s); palpes maxillaires longues, recouvertes, sur leur dernier segment, par un grand nombre de poils longs et fins (fig. 1S) .... *P. submarginata*

- Première branchie de même longueur, ou à peine plus courte, que les autres (fig. 3T); sur la face inférieure des fémurs postérieurs épines effilées (fig. 4c, t); palpes maxillaires plus courtes, recouvertes, sur leur dernier segment, par un moins grand nombre de poils longs et fins (fig. 1C) 5

5. Sur la face inférieure des fémurs postérieurs, épines effilées, à extrémités pointues, rarement courtes (fig. 4t); la rangée de dents atteint presque les 3/4 de la griffe (fig. 4T) .... *P. tumida*

- Sur la face inférieure des fémurs postérieurs, épines effilées mais à extrémités tronqués (fig. 4c); la rangée de dents dépasse à peine la moitié de la griffe (fig. 4c) ...... *P. cincta*

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The algal flora of southeastern United States VI. Additions to our knowledge of the desmid genus Euastrum 2.

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Herein are presented two new species and a number of new varieties and forms of existing species, which have been found in gatherings made since the publication of our previous paper on *Euastrum* (1945). Nearly all of them, as will be noted, come from the State of Florida, the rich desmid-flora at which has previously been commented upon by us and other authors. The number of Euastra known from southeastern United States now totals 56 species, 59 varieties, and 18 named forms.

We wish to express our thanks to Dr. Hannah Croasdale for translating the diagnoses into Latin, and to Mrs. Dorothy Perine, Jr., for inking the senior author's pencil drawings.

All measurements are given in microns, and the following abbreviations are used: L. = length; W. = width; T. = thickness; I. = isthmus. The symbols (Fla. 25) refer to the senior author's collections, duplicates of which have been deposited in the Farlow Herbarium, Harvard University.

Euastrum acmon West & West var. TURGIDUM var. nov. Pl. I, Fig. 10. A variety smaller than the typical and with two prominent protrusions on the median facial protuberance; polar incision broader and more concave than in the typical; in lateral view semicells

transversely elliptic, the lateral margins greatly distended so that the cell is approximately as thick as the semicell is high; in vertical view broadly oval to almost circular in outline, the poles narrowly rounded and with two prominent marginal protrusions on each side in the midregion. L. 30—31; W. 22; T. 18—19; I. 5—6.

Varietas minor quam planta typica, duos protrusiones prominentes in protuberatione media faciali habens; incisio polaris latior et magis concava quam in planta typica; semicellulae a latere visae transverse ellipticae, marginibus lateralibus multum distensis, ita ut cellula quasi aeque crassa ac semicellula alta sit; semicellulae a vertice visae late ovatae ad fere circulares, polis anguste rotundatis, duos protrusionibus marginalibus prominentibus utrimque media in parte visis. Long. 30—31; lat. 22; crass. 18—19; isthm. 5—6.

The specific form and var. *clausum* West and West were originally found in Angola, West Africa, and apparently have not been recorded since.

Florida: Cypress swamp 12.5 miles north of Port St. Joe, Gulf Co. (Fla. 25). Pond 20 miles east of Panama City, Bay Co. (Fla. 47).

Euastrum bidentatum var. *oculatum* (Istv.) Krieg. fa. GLABRUM fa. nov. Pl. III, Fig. 1.

A form differing from the variety by having the supraisthmian protuberance smooth and evenly rounded, and by having more or less prominent depressions in the face of the semicell just within the margin of each lateral invagination of the wall; in lateral view semicell inversely cone-shaped from a widely open median incision of the cell, with a smoothly rounded protuberance near the base of the semicell and a slight bulge about half-way between the basal protuberance and the somewhat narrowly rounded apex; a mucilage pore showing between the basal protuberance and the intermediate protuberance. L. 60—61; W. 36—37; T. 25; I. 9—10.

Forma a planta typica differens protuberatione supraisthmali levi atque aequaliter rotundata, et possessione depressionum plus minusve prominentium in superficie semicellulae admodum intra marginem cuiusque invaginationis lateralis membranae; semicellula a latere visa inverse conica ab incisione media late aperta cellulae; et praebens protuberationem leviter rotundatam ad basim semicellulae necnon gibbum circa media in parte inter protuberationem basalem atque apicem quasi anguste rotundatam; porus mucosus inter protuberationem basalem atque protuberationem intermediam visus. Long. 60—61; lat. 36—37; crass. 25; isthm. 9—10.

Florida: Ditch 6 miles south of Punta Gorda, Charlotte Co. (Fla. 76). Swamp 7 miles west of Melbourne, Brevard Co. (Fla. 131).

Euastrum bidentatum Naeg. var. QUADRIOCULATUM var. nov. Pl. I, Fig. 4.

A variety differing from the typical by having two pores within the lateral margins on each side of the semicell in the mid-region, in addition to the two pores in the face of the semicell; and also differing by having a reduction in the number and size of granules on the wall; central facial protuberance reduced to a low swelling; in lateral view showing six mucilage pores, one on either side in the mid-region and four pores quadrately placed around the center of the ovate semicell; in polar view quadrangularly oval, the lateral margins parallel or slightly convex and with a lateral median protuberance which is without decorations, the poles abruptly rounded, four mucilage pores showing, two on either side just within the margin of the central protuberance. L. 56; W. 36; T. 22; I. 8.

Varietas a planta typica differens accessione duorum pororum intra margines laterales utroque in latere semicellulae media in parte, ad duos poros in superficie semicellulae; differens necnon reductione numeri magnitudinisque granulorum in membrana; protuberatio cantralis facialis in inflationem humilem reducta; semicellula a latere visa praebens 6 poros mucosos, unum utrimque media in parte, necnon 4 circum centrum semicellulae ovatae quadrate positos; semicellula a polo visa quadrangulariter ovata, marginibus lateralibus parallelis vel paululum convexis et protuberationem mediam lateralem sine decorationibus praebens; polis abrupte rotundatis, quattuor poris mucosis apparentibus; duo utrimque admodum intra marginem protuberationis centralis. Long. 56; lat. 36; crass. 22; isthm. 8.

Florida: Ditch 10 miles southeast of Port St. Joe, Gulf Co. (Fla. 59).

This variety should be compared with *E. oculatum* Boerges. which it resembles in shape of cell as seen in side view. Like that species also the Florida plants have almost smooth walls. But the form of the basal angles and the deep polar incision identify this plant with *E. bidentatum.*

Euastrum Ciastonii Racib. var. APERTISINUATUM var. nov. Pl. I, Fig. 5. A variety differing from the typical by having a sinus that opens outwardly from a sharply rounded apex; also differing in its possession of additional granules just within the polar margins of the apical lobules. L. 40—44; W. 27; I. 6.

Varietas a planta typica differens possessione sinus ab apice acute rotundato extrorsum aperti; necnon differens possessione granulorum additiciorum admodum intra margines polares apicalium. Long. 40—44; lat. 27; isthm. 6.

Florida: Small lake 12 miles north of Lynn Haven, Bay Co. (Fla. 35).

Euastrum Ciastonii var. ASYMMETRICUM var. nov. Pl. I, Fig. 6. A variety differing from the typical by having the lower lateral margins of the basal lobes distinctly diverging to rather abruptly rounded lateral angles, the upper lateral margins more deeply retuse, and in having a crest of three granules just within the polar margin of the apical lobules on either side of the median notch; in the face of the semicell differing by having two protuberances in the mid-region which bear two to four granules, one protuberance being distinctly larger than the other; oval in end view, the poles with a marginal series of four granules, with two protuberances in the mid-region on each side, one of which is larger than the other and bidentate rather than simple, and in position diagonally opposite the bidentate protuberance on the other side of the cell. L. 45; W. 29—30; T. 21; I. 8.

Varietas a planta typica differens marginibus lateralibus inferioribus loborum basalium ad angulos laterales quasi abrupte rotundatos distincte divergentibus, marginibus lateralibus superioribus profundius retusis; differens necnon possessione cristae 3 granulorum admodum intra marginem polarem lobulorum apicalium utroque in laterale incisurae mediae; differens necnon media in facie semicellulae possessione 2 protuberationum 2—4 granula ferentium, una protuberatione admodum maiore quam altera; semicellula a polo visa ovata, polis series marginales 4 granulorum habentibus, et 2 protuberationibus utrimque media in parte, una maiore quam altera et bidentata, non simplici, et positu protuberationi bidentatae altero in latere semicellulae diagonaliter opposita. Long. 45; lat. 29—30; crass. 21; isthm. 8.

Mississippi: Swamp 2 miles west of Pascagoula, Jackson Co. (Miss. 88).

Euastrum crassum (Bréb.) Kuetz. Pl. II, Fig. 1.

In southeastern United States the specific form of this plant is much rarer than the several varieties. The form figured herewith has the proportions of var. *microcephalum* Krieg. and var. *michiganense* Presc., but the poreless wall and the facial protuberances of the typical plant. The wall instead of being coarsely scrobiculate is rather finely punctate. L. 179; W. 77; T. 57; I. 24.

Florida: Swamp 3 miles east of Bruce, Walton Co. (Fla. 11).

Euastrum crassum var. *scrobiculatum* Lund. fa. Pl. II, Fig. 3.

This form has the lateral margins of var. *microcephalum* Krieg., but the apical lobe and depth of sinus between the polar lobe and the basal lobe which are characteristic of var. *scrobiculatum*. Like

the latter it possesses a central mucilage pore in the face of the semicell. L. 157; W. 76; I. 25.

Florida: Pond 6 miles south of Masaryk, Hernando Co. (Fla. 110).

Euastrum denticulatum var. *rectangulare* West & West, fa. Pl. III, Fig. 9.

A variety in which the poles of the cell are approximately as wide as (or a little wider than) the base of the semicell. The granules about the median notch are lacking in the Florida specimens and the lateral margins are more deeply invaginated below the apex than described for the typical. L. 19; W. 15; T. 11; I. 5.

Florida: Swamp 14 miles west of Torrey, Hardee Co. (Fla. 114).

Euastrum evolutum var. *integrius* West & West fa. TURGIDUM fa. nov. Pl. III, Figs. 4, 5.

A form in which there is a reduction in the teeth along the margin of the basal lobes and which in lateral view shows the upper lateral margins broadly convex and sloping to a rather sharply rounded apex, with a low protuberance on each side just below the pole and with the median protuberance less prominently developed than in the typical. L. 50—53; W. 36—39; T. 21; I. 8—9.

Forma nota dentium reductione secumdum marginem loborum basalium et, a latere visa, marginibus lateralibus superioribus late convexis et ad apicem quasi acute rotundatum devectis, protuberatione depressa utrimque admodum infra polum, protuberatione media minus prominenter effecta quam in varietate typica. Long. 50—53; lat. 36—39; crass. 21; isthm. 8—9.

Florida: Ditch 4 miles east of LaBelle, Hendry Co. (Fla. 129).

Louisiana: Swamp 4.5 miles south of Ponchatoula, Tangipahoa Parish (La. 111).

The shape of the polar lobe (with subparallel margins) seems to identify this plant with var. *integrius*, but in lateral view it is relatively thicker and is convex along the lateral margins where that variety is retuse. Pl. III, Fig. 5 shows a form from Louisiana approaching var. *trilobum* (Boerges.) Krieg. in the shape of the base of the semicell, but has the apical lobe of var. *integrius*. The former variety is without mucilage pores.

Euastrum evolutum var. *monticulosum* (Tayl.) Krieg. fa. PORIFERUM fa. nov. Pl. III, Fig. 2.

A form differing from the typical by having two large mucilage pores in a transverse line just above the facial protuberance which is triangular, and in having the wall coarsely scrobiculate in the mid-

region of the semicell, especially just below and around the facial protuberance. L. 71—78; W. 48—51; T. 28—34; I. 12.

Forma a planta typica differens possessione duorum pororum mucosorum magnorum linea in transversa admodum supra protuberationem facialem, quae triangularis est; differens necnon membrana media in parte semicellulae grosse scrobiculata, praecipue admodum infra circaque protuberationem facialem. Long. 71—78; lat. 48—51; crass. 28—34; isthm. 12.

Florida: Ditch 2.5 miles southeast of Myakka City, Manatee Co. (Fla. 115).

Euastrum evolutum (Nordst.) West & West var. REDUCTUM var. nov. Pl. III, Fig. 3.

A variety differing from the typical by having the lateral lobules of the semicell much reduced and with shallow invaginations of the lateral margins rather than incisions; the spinescence of the polar lobules also reduced; in lateral view pole truncate with a protuberance on each side but broadly convex at the apex. L. 58—60; W. 39—40; T. 28; I. 9—10.

Varietas a planta typica differens lobulis lateralibus semicellulae multum reductis, marginibus lateralibus paululum invaginatis magis quam incisis; spinescentia lobulorum polarium necnon reductis; polus a latere visus truncatus, protuberatione utroque in latere, in apice, autem, late convexus. Long. 58—60; lat. 39—40; crass 28; isthm. 9—10.

Florida: Ditch 1 mile west of Holopaw, Osceola Co. (Fla. 135).
Swamp 15 miles west of Sanford, Volusia Co. (Fla. 138).
Pond 3 miles west of Sorrento, Lake Co. (Fla. 140).
Pond 8 miles east of Myakka State Park, Sarasota Co. (Fla. 167).

Euastrum fissum West & West var. ANGUSTUM var. nov. Pl. III, Fig. 7.

Cells proportionately narrower than in the typical, about twice as long as wide; cells nearly rectangular in outline, widest in the region just above the base of the semicells, the width reduced at the polar lobe to about that of the basal lobe at the isthmus; with supernumerary granules within the margins of the lobules of the polar lobe; in side view similar to the typical, but with a granule on each side just below the apex. L. 38—41; W. 19—20; T. 15; I. 5.

Cellulae proportione angustiores quam in planta typica, saltem duplo longiores quam latae; cellulae ambitu fere rectangulares; latissimae regione admodum supra basim semicellularum, latitudo ad lobum polarem ad circa latidudinem lobi basalis ad isthmum reducta; granula supranumeraria intra margines lobulorum lobi

apicalis; semicellula a latere visa plantae illi typicae similis, praebens, autem, granulum utrimque admodum infra apicem. Long. 38—41; lat. 19—20; crass. 15; isthm. 5.

Florida: Swamp 9 miles southeast of Naples, Collier Co. (Fla. 80).
Swamp 14 miles west of Torrey, Hardee Co. (Fla. 114).
Ditch 9 miles east of Bradenton, Manatee Co. (Fla. 121).
Swamp 7 miles west of Melbourne, Brevard Co. (Fla. 131)

Euastrum fissum West & West var. DECORATUM var. nov. Pl. I, Figs. 1, 2.

A variety twice the diameter in length, narrower at the poles than at the base of the semicells, the basal angles rather sharply rounded and furnished with a short tooth-like spine, the lateral margins at first converging and then diverging to form the polar lobe, the upper margin of which slopes toward the relatively deep and narrow apical incision, the tip of the polar lobules sometimes furnished with sharp granules; the upper lateral angles and margins of the polar lobe devoid of spines characteristic of the typical; face of the semicell decorated with a central area of granules arranged in three vertical series of two or three; a protuberance in the mid-region of each apical lobule furnished with a circular arrangement of rather large granules; a granule just within the upper margin of the apical lobules, and two or three granules within the margin of the basal lobes of the semicell; a granule on either side of the apex of the polar notch; sinus narrow and closed throughout; in lateral view semicell triangularly cone-shaped in outline, the basal angles and the apex broadly rounded, with a series of three prominent granules showing along the margin of the base of the semicell, a granule on each margin about half-way to the apex above which is a prominent cylindrical protuberance tipped with three granules, with a marginal granule on each side just above the protuberance and just below the apex which is smooth. L. 54—59; W. 27—30; T. 18; I. 7—9.

Varietas duplo longior quam lata, angustior ad polos quam ad basim semicellularum; angulis basalibus quasi acute rotundatis et spina brevi dentiformi praeditis, marginibus lateralibus convergentibus, deinde, ad lobum polarem efficiendum, divergentibus, margine superiore lobi polaris ad incisionem apicalem, relative profundam angustamque devecto, cacumine lobulorum polarium granulis acutis interdum praedito; margines laterales superiores atque anguli lobi polaris carentes spinis plantae typicae propriis; superficies semicellulae area centrali granulorum, in 3 seriebus verticalibus binorum aut trinorum ordinatorum, ornata; protuberatio media in parte cuiusque lobuli apicalis ordinatione circulari granulorum satis magnorum praedita; granulum unum admodum intramarginem

superiorem lobulorum apicalium atque 2 vel 3 granula intra marginem loborum basalium semicellulae; granulum unum utroque in latere apicis incisurae polaris; sinus angustus, prorsus inapertus; semicellula a latera visa ambitu triangulariter conica, angulis basalibus atque apice late rotundatis, serie 3 granulorum prominentium secundum marginem basis semicellulae visa, granulo uno utroque in margine, media in parte; apex protuberationem cylindricam prominentem, in cacumine 3 granulis munitam, formans, granulo marginali utrimque admodum supra protuberationem atque infra apicem levem. Long. 54—59; lat. 27—30; crass. 18; isthm. 7—9.

Florida: Ditch 5 miles west of Wewahitchka, Gulf Co. (Fla. 48).

This variety is larger than the typical or any of the described varieties, and is somewhat narrower in proportions. It has much in common with *E. elegans* (Bréb.) Kuetz. and some of its numerous expressions. The pincers type of polar lobe with a deep apical notch identify the Florida specimens with the *E. fissum* series rather than with *E. elegans.*

Euastrum fissum West & West var. PSEUDOELEGANS var. nov. Pl. I, Fig. 3.

A variety larger than the typical, about twice the diameter in length; semicells wider at the apex than at the base; basal angles sharply rounded, the lateral margins converging throughout two-thirds of the distance to the apex and then diverging to the upper lateral angles which bear a straight, horizontally projecting spine: the dorsal margin of the apical lobe sloping gently to the deep median notch and forming a broadly rounded apex; basal angles with a short blunt tooth on the margins and with three granules in a triangular pattern just within the margin; with a very slight protuberance of the margin about half-way to the apex; face of semicells with a protuberance in the mid-region furnished with three vertical rows of granules, three in each row; with a protuberance bearing a circular pattern of granules in the mid-region of the two apical lobules and with a bidentate granule just within the margin at the apex on either side of the median notch; sinus linear and closed; lateral view of semicell ovate in outline, lateral margins convex at the base and extending into prominent lateral protuberances bearing three crenations, upper lateral margins deeply retuse between the basal protuberances and a bidentate protuberance on each side just below the apex which is rather sharply rounded, two granules showing on each side between the upper lateral protuberances and the apex; in end view broadly oval with a tricrenate swelling in the mid-region on each side, the poles broadly rounded and showing a pair of subpolar granules at the margin on each side. L. 58; W. 31; W. polar lobe 33; T. 23; I. 10.

Varietas maior quam planta typica, circa duplo longior quam lata; semicellulae latiores in apice quam in basi; anguli basales acute rotundati, marginibus lateralibus per 2/3 spati ad apicem convergentibus, deinde ad angulos laterales superiores, spinem rectam horizontaliter eminentem ferentes, divergentibus; margo dorsalis lobi apicalis ad incisuram mediam profundam leniter devectus et apicem late rotundatum efficiens; anguli basales dente brevstet obtuso in marginibus atque 3 granulis in triangulum ordinatis admodum intra marginem praediti; protuberatio minima marginis circa media in parte; superficies semicellularum protuberationem, media in parte 3 ordinibus verticalibus granulorum, 3 utroque in ordine praeditam, habens; protuberatio ordinationem spinarum circularem ferens media in parte lobulorum apicalium duorum, et granulum bidentatum admodum intra marginem in apice utroque in latere incisurae mediae visum; sinus linearis inapertusque; semicellula a latere visa ovata, marginibus lateralibus ad basem convexis et in protuberationes laterales prominentes, 3 crenationes ferentes, extensis, marginibus lateralibus superioribus inter protuberationes basales et protuberationem bidentatum utrimque admodum infra apicem quasi acute rotundatum profunde retusis, granulis duobus utrimque inter protuberationes laterales superiores et apicem visis; semicellula a polo visa late ovata, inflatione tricrenata media in parte utrimque, polis late rotundatis, par granulorum subpolarium in margine utrimque praebens. Long. 58; lat. 31; lat. lobi polares 33; crass. 23; isthm. 10.

Florida: Lily pond 21 miles east of Panama City, Bay Co. (Fla. 43).

This variety is suggestive of *E. elegans* especially because of the broad, almost flat apical margin and the horizontally directed spines at the angles of the polar lobe. The deep polar incision and the form of the cell as seen in lateral view identify it with *E. fissum.*

Euastrum FLORIDENSE sp. nov. Pl. I, Fig. 11.

Cells large, a little more than twice the diameter in length, subrectangular in outline with the polar lobe as wide as the basal lobes of the semicell; lower lobules broadly rounded or with margins subparallel, above which is a deep V-shaped invagination of the margin that extends upward to form broadly rounded upper lateral lobules; a deep, narrow sinus separating the lower part of the semicell from the broad and high polar lobe, the upper lateral margins of the polar lobe converging to a truncate apex in which the polar incision is narrow and moderately deep; face of the semicell with one median and two lateral protuberances (one on either side), just above the isthmus and the sinus; wall coarsely scrobiculate; mucilage pore lacking (?); in side view elongate-oval, the poles broadly rounded and smooth, the lateral margins scarcely showing any swellings but

nearly entire, the median incision shallow and slightly open, the sides parallel. L. 104; W. maximum 48; W. at base of semicell 46; T. about 32; I. 16.

Cellulae magnae, paulo magis quam duplo longiores quam latae, ambitu subrectangulares, lobi polari latitudine aequo lobis basalibus semicellulae; lobulis lateralibus inferioribus late rotundatis aut margines subparallelos habentibus; supra, invaginatio marginis profunde, V-formis, ad lobulus laterales superiores late rotundatos formandos, sursum extensa; sinus profundus angustusque partem semicellulae inferiorem a lobo polari lato altoque seiungens, marginibus lateralibus superioribus lobi polaris ad apicem truncatum, incisione polari angusto atque quasi profundo praeditum, convergentibus; superficies semicellulae protuberationem mediam atque duas protuberationes laterales (unam utrimque) admodum supra isthmum sinumque praebens; membrana grosse scrobiculata; porus mucosus deest (?); cellula a latere visa elongato-ovata, polis late rotundatis atque levibus, marginibus lateralibus fere integris, inflationibus quasi nullis, incisione media non alta, paululum aperta, lateribus parallelis. Long. 104; lat. maximum 48; latitudino in basi semicellulae 46; crass. circa 32; isthm. 16.

Florida: Pond 20 miles east of Panama City, Bay Co. (Fla. 47).

This rare species is nearest *E. Allenii* Cushman but differs especially in the form of the polar lobe. *E. Allenii* has the upper lateral margins of the polar lobe with broad and deep invaginations. Also it does not have the narrower and deep sinus between the basal lobes and the polar lobes of the cell. Like *E. Allenii*, however, the Florida plant is broader in the mid-region of the semicell than at the basal lobes.

Euastrum giganteum (Wood) Nordst. Pl. I, Fig. 13.

Cells large, elongate, subrectangular in outline, the margins of the cells subparallel, the poles broadly truncate with rather abruptly rounded angles, lateral margins entire, slightly convex from the narrow, deep sinus to the truncate poles, just below which the margins are slightly retuse; median notch narrows relatively shallow; face of semicell with a large supraisthmian protuberance with a lower protuberance on each side just above the isthmus; in side view cells elongate, about the same shape as in front view, but about one-eighth less in thickness than in width, the poles broadly rounded, margins entire and subparallel. L. 202—218; W. 66—70; T. 59; I. 25—29.

Florida: Pond 2 miles west of Milton, Santa Rosa Co. (Fla. 66).

Euastrum hypochondrum Nordst. fa. DECORATUM fa. nov. Pl. III, Fig. 10.

A form similar to the typical but larger in all dimensions, and with the median facial protuberance more prominent, the wall throughout decorated with larger granules which are round or conical; in end view usually with a relatively deep invagination of the wall on either side of the median protuberance. L. 60—72; W. 57—66; T. 35—39; I. 12—15.

Forma plantae typicae similis, maior, autem, ubique, necnon protuberatione faciali media magis prominente, tota membrana granulis maioribus, rotundis conicisve ornata; semicellula a vertice visa invaginationem membranae relative profundam utroque in latere protuberationis mediae plerumque praebens. Long. 60—72; lat. 57—66; crass. 35—39; isthm. 12—15.

Florida: Lake near Lebanon Station, Levy Co. (Fla. 74).
Ditch 2 miles south of Bonita Springs, Lee Co. (Fla. 79).
Pond 21 miles southwest of Ocala, Marion Co. (Fla. 163).

Euastrum hypochondrum Nordst. fa. PROMINENS fa. nov. Pl. III, Fig. 13.

A form in which the central facial protuberance is narrower and more prominent as seen in side or end view than in the typical, the lower lateral margins of the basal lobes somewhat more divergent than in the typical, with three rows of granules encircling the polar lobes. L. 54—56; W. 49—55; T. 25—28; I. 11—12.

Forma protrusione centrale faciali, a latere verticeve visa, angustiore et prominentiore quam in planta typica, marginibus lateralibus inferioribus loborum basalium aliquanto magis divergentibus quam in planta typica; tres ordines granulorum lobos polares circumdantes. Long. 54—56; lat. 49—45; crass. 25—28; isthm. 11—12.

Florida: Ditch 7 miles south of Fort Myers, Lee Co. (Fla. 78).
Ditch 8 miles south of Punta Gorda, Charlotte Co. (Fla. 77)
Swamp 9 miles south of Naples, Collier Co. (Fla. 80).
Pool in coral rock, 6 miles southwest of Homestead, Dade Co. (Fla. 84).

E. hypochondrum and its variations show definite relationships with *E. platycerum* Reinsch, *E. madagascariense* (West & West) Krieg., and a group of species which have no polar notch, all of which are so distinctive that they present a very clear evolutionary series, ending with *E. verrucosum* Ehrbg., or beginning with it, depending on one's point of view in respect to reduction of the cell complexity in the evolution of desmids.

Euastrum informe Borge fa. OCULATUM fa. nov. Pl. III, Fig. 8.

A form differing from the typical by having a large mucilage pore medianly located just above the facial protuberance of the semicell. L. 39—44; W. 18—19; T. 14; I. 5.

Forma a planta typica differens posessione pori mucosi magni media in parte admodum supra protuberationem facialem semicellulse. Long. 39—44; lat. 18—19; crass. 14; isthm. 5.

Mississippi: Pond, Highway 26, 3 miles west of Pascagoula River Ferry, George Co. (Miss. 74).

Florida: Lily pond 13 miles east of Fort Walton, Okaloosa Co. (Fla. 6).

Lily pond 21 miles west of Panama City, Bay Co. (Fla. 43)

Pond 3 miles west of Sorrento, Lake Co. (Fla. 140).

This is the third record only of the occurrence of this species, found first in Brazil by Borge, later (1935) in Massachusetts by Prescott. The Massachusetts specimens definitely were without mucilage pores, but whether this is true also of the type specimen cannot be determined inasmuch as Borge was not able to give a full description of the wall features. In the Mississippi and Florida specimens, it is very difficult to determine whether the pore is present in the case of living plants, or preserved cells that retain the chloroplast. It is present in all of the empty cells or semicells that have been examined from these States.

Euastrum insigne var. *lobulatum* Presc. & Scott fa. ACUTILOBUM fa. nov. Pl. II, Fig. 4.

A form differing from the typical variety by having the lower basal angles of the semicell narrower and much extended horizontally, and by having prominent lobules on the upper margins of the basal lobes; the polar lobe narrower with subparallel lateral margins, the apical lobules much produced and horizontally extended; sinus more open with widely divergent sides; wall deeply scrobiculate. L. 111; W. 78; I. 15.

Forma a varietate typica differens angulis basalibus inferioribus semicellulae angustioribus et horizontaliter multum extensis, differens necnon possessione lobulorum prominentium in marginibus superioribus loborum basalium; lobus polaris angustior, marginibus lateralibus subparallelis, lobulis apicalibus multum productis atque horizontaliter extensis; sinus apertior, lateribus late divergentibus; membrana profunde scrobiculata. Long. 111; lat. 78; isthm. 15.

Florida: Pond 6 miles south of Masaryk, Hernando Co. (Fla. 110).

Euastrum INVAGINATUM sp. nov. Pl. I, Fig. 8.

Cells medium-sized, about twice the diameter in length; narrowly oval in outline; the semicells semi-oval in shape with a very deep polar notch that is broadly open internally to form a prominent invagination that extends almost to the mid-region of the semicell, the resulting lobules of the cell pincer-shaped; margin of the semicell

showing about nine crenulations between the sharp basal angles and the apex; face of the semicell with an almost imperceptible swelling in the mid-region; the wall thin and coarsely punctate; median incision deep, the sinus narrow and closed throughout; in lateral view the cell fusiform in outline with a V-shaped incision in the mid-region, the apices truncate, the base of the semicell only slightly swollen, the margins undulate; in end view quadrate-oval, the lateral margins nearly parallel, with a slight protrusion on each side, the poles broadly convex and crenate, with three or four series of crenations within the margin. L. 42; W. 20—25; T. about 12; I. 7—8.

Cellulae mediocres, circa duplo longiores quam latae; anguste ovatae; semicellulae semi-ovatae, incisura polari profundissima, ad invagationem prominentem, prope ad mediam semicellulam extensam, formandam, interne late aperta, lobulis cellulae sic formatis forcipiformibus; margo semicellulae circa 9 crenulationes inter angulos basales acutos atque apicem praebens; superficie semicellulae inflationem vix perceptam media in parte habens; membrana grosse punctata; incisio media profunde, sinu angusto et prorsus inaperto; cellula a latere visa fusiformis. incisionem V-formem media in parte praebens, apicibus truncatis, basi semicellulae paululum inflata, marginibus undulatis; cellula a polo visa quadrato-ovata, marginibus lateralibus fere parallelis, protrusione minore utrimque media in parte, polis late convexis crenatisque, 3 vel 4 series concentricas crenationum intra marginem praebentibus. Long. 42; lat. 20—25; crass. circa 12; isthm. 7—8.

Florida: Ditch 3 miles east of Gulf Breeze, Santa Rosa Co. (Fla. 2).
Ditch 0.5 mile south of Westbay, Bay Co. (Fla. 9).

This delicate little desmid has a combination of characteristics that make it unlike any known species of Euastrum, though there is a distant resemblance to *E. bilobum* Lutkem., which according to Krieger (1937, p. 109) is an arctic species. The marginal crenulations shown in front view combine with those of the vertical view to form a "rippled" surface, which is only noticeable in oblique views. The cell is so thin as to give a superficial resemblance to *Tetmemorus* when seen in side view, and suggests a possible intermediate form.

Euastrum pectinatum Bréb. var. LOBULIFERUM var. nov. Pl. I, Fig. 12.

This variety differs from the typical by having thicker lateral lobules of the polar lobe of the semicells, their apices more broadly rounded, and in having thicker, bilobate lower lateral lobes; the sinus narrow and closed throughout; also differing by having a supracentric mucilage pore in the face of the semicell surrounded by three low swellings, and with an intramarginal mucilage pore on

each side of the polar incision which is characteristically very shallow; wall finely scrobiculate; in lateral view semicell thicker than in the typical, with marginal protuberances just below the poles rather than an invagination, also with secondary lobules at the base of the semicell where the median incision is narrow and deep; in end view broadly elliptic in outline, with two prominent swellings in the mid-region on each side, and with two lower swellings between the mid-region and the poles (six marginal swellings on each side). L. 70—74; W. 52—54; T. 30; I. 11—12.

Varietas a planta typica differens lobulis lateralibus lobi polaris semicellularum crassioribus, apicibus lobulorum latius rotundatis, differens necnon lobis lateralibus inferioribus bilobatis crassioribus; sinus angustus atque prorsus inapertus; differens necnon possessione pori mucosi supracentrici in semicellulae superficie, tribus incrassationibus inferioribus circumdati, possessione necnon pori mucosi intramarginalis utroque in latere incisionis polaris, proprie quidem minime alti; membrana subtiliter scrobiculata; semicellula a latere visa crassior quam in planta typica, praebens admodum infra polos protuberationes marginales potius quam invaginationem, praebens necnon lobulos secondarios in basi semicellulae, ubi incisio media angusta profundaque est; semicellula a vertice visa late elliptica, 2 inflationes prominentes utrimque media in parte atque 2 inflationes inferiores inter partem mediam et polum habens (6 inflationes marginales utrimque). Long. 70—74; lat. 52—54; crass. 30; isthm. 11—12.

Florida: Ditch 0.5 mile south of Cottondale, Jackson Co. (Fla. 31). Ditch 17 miles north of Okechobee, Okechobee Co. (Fla. 91).

Euastrum pingue Elfv. Pl. I, Fig. 7.

Cells medium sized, about $1\frac{1}{4}$ times longer than broad, oval in outline; semicells truncate-pyramidate, the basal angles broadly rounded, the upper lateral margins deeply retuse above the broad basal angles, and then approximately straight to form the polar lobe which is truncate or broadly convex; apical notch narrow and sharp but relatively shallow; face of semicell with a broad, low swelling eccentrically placed to the left of the vertical center-line in the upper semicell and to the right of the center-line in the lower semicell, with a prominent supramedian mucilage pore also eccentrically placed to the right of the center-line in the upper semicell and to the left in the lower one; with a prominent supraisthmian granule at the base of the semicell; wall finely scrobiculate, especially at the angles and on the median protuberance; in side view semicells inversely subnapiform, the basal portion broadly oval to nearly circular in

outline, but then narrowed with retuse margins to form a convex pole, a prominent granule showing at the base of the semicell on each side, and a mucilage pore well within the left margin of the upper semicell about half-way to the pole, and a similar pore within the righthand margin of the lower semicell, the swollen mid-region showing a series of crenulations at the margin; in end view quadrate-oval, the poles truncately convex, the mid-region with a prominent crenulate protuberance which is diagonally opposite the protuberance on the other side, a mucilage pore showing just within the margin midway between the poles and the central protuberance, diagonally opposite a pore on the other side. L. 50—55; W. 36—38; T. 25; I. 12.

Florida: Lily pond 11 miles east of Fort Walton, Okaloosa Co. (Fla. 5).

Previous illustrations of this desmid do not clearly bring out the fact that the central swellings as well as the mucilage pores are eccentrically placed with regard to the vertical center-line. Also it is to be noted that the illustration in Krieger (1937, Pl. 61, Fig. 22) has been reversed, no doubt in the copying process, so that the mucilage pores are shown on the wrong side of the center-line.

Euastrum platycerum var. *acutilobum* Krieg. fa. DENTIFERUM fa. nov. Pl. III, Fig. 12.

A form differing from the typical variety by having a more highly decorated wall in the form of granules both on the face of the semicell and around the poles, and by having a prominent tooth-like supraisthmian granule; the lateral lobes of the semicells more nearly horizontal than in the typical variety. L. 57—60; W. 54—56; T. 27; I. 11—12.

Forma a varietate typica differens membrana magis ornata, granulis et in superficie semicellulae et circum polos visis, differens necnon possessione granuli prominentis dentiformis supraisthmalis; lobi laterales semicellularum plus horizontales quam in varietate typica. Long. 57—60; lat. 54—56; crass. 27; isthm. 11—12.

Florida: Swamp 9 miles southeast of Naples, Collier Co. (Fla. 80).

Euastrum sphyroides Nordst. fa. GRANULATUM fa. nov. Pl. III, Fig. 11.

A form differing from the typical by having three rows of granules encircling the apical lobe (one row intramarginal), and in having a prominent supraisthmian granule just below the facial protuberance which is decorated with a central pattern of four granules, encircled by a ring of granules in which the one nearest the isthmus is larger. L. 52—54; W. 43—51; T. 22—26; I. 10—12.

Forma a planta typica differens possessione 3 ordinum granulorum

apicalem circumdatium (ordine uno intramarginali), atque granuli supraisthmalis prominentis admodum infra protuberationem facialem, ordinatione centrali 4 granulorum ornatam, hac annulo granulorum, illo, quod isthmo proximum, maiore, circumdata. Long. 52—54; lat. 43—51; crass. 22—26; isthm. 10—12.

Florida: Ditch 18 miles south of Venice, Sarasota Co. (Fla. 75). Pond in coral rock, 6 miles southwest of Homestead, Dade Co. (Fla. 84).

Euastrum Turneri West & West fa. PORIFERUM fa. nov. Pl. III, Fig. 6.

A form differing from the typical by its possession of two mucilage pores in a horizontal line just above the facial protuberance of the semicell, and by having a much deeper polar incision; the wall lightly but rather irregularly scrobiculate; in lateral view without the undulating upper lateral margins characteristic of the typical. L. 46—51; W. 31—36; T. 19; I. 7—9.

Forma a planta typica differens possessione duorum pororum mucosorum horizontaliter ordinatorum admodum supra semicellulae protuberationem superficialem, differens necnon incisione polari multo profundiore; membrana subtiliter, paululum irregulariter autem, scrobiculata; semicellula a latere visa sine marginibus superioribus undulatis propriis plantae typicae. Long. 46—51; lat. 31—36; crass. 19; isthm. 7—9.

Euastrum Turneri var. *stictum* (Boerges.) nobis comb. nov. (Syn. *E. denticulatum* var. *stictum* Boerges.). Pl. I, Fig. 9.

This desmid has been found at three stations in Florida, and also in material from Arnhem Land in North Australia which we have examined (to be published later). Its characteristics agree very well with the original illustration of the Brazilian plant by Boergesen (1890), and also with the figure of the Queensland specimens by Borge (1911). The North Australian collections contain a number of desmid species that were found by Borge in the adjacent State of Queensland, so that it seems quite likely that the Arnhem Land specimens are the same as those seen by Borge. Boergesen's assignment to *E. denticulatum*, however, seems incorrect, since there are too many differences between the plants. Krieger (1937) lists Boergesen's name as a synonym of *E. Turneri* W. West. This also seems undesirable, because of the much deeper apical notch, and the smoothly undulate lateral margins (with projecting granules) as shown in our figure, as compared with the illustrations by West & West (1905) Pl. XXXVII, Figs. 9, 10, which show a deep incision separating the apical lobules from the lateral lobes, and the bilobulate lateral lobes

noted in the description by West & West. We think the best solution of the difficulty is to name the plant as a variety of *E. Turneri*, using Boergesen's varietal name, var. *stictum.* L. 36—37; W. 25—26; T. about 18; I. 7.

Florida: Pond 5 miles south of Marianna, Jackson Co. (Fla. 20).
Swamp 7 miles south of Greenville, Madison Co. (Fla. 238).
Ditch 8 miles east of Hosford, Liberty Co. (Fla. 245).

Euastrum ventricosum Lund. var. SOPCHOPPIENSE var. nov. Pl. II, Fig. 2.

Cells large, 1.8 to 2 times as long as wide; basal angles sharply rounded and extended so as to overlap the angles of the other semicell, thus closing the median sinus which is deep and enlarged internally; lateral margins broadly concave and then diverging into the upper lateral lobules which are narrow and directed upward at a sharp angle, with a deep sinus between them and the polar lobe which is broadly cuneate; the apical margin convex and with a narrow polar incision; face of the semicell with a prominent supraisthmian protuberance and with a smaller intramarginal protuberance on either side at the base of the semicell, and with a low protuberance in the mid-region of the apical lobules; wall coarsely scrobiculate; in lateral view semicell truncate-pyramidate with the margins evenly converging to an enlarged apex which is trilobed; vertical view ellipsoid in outline with a protuberance on either side of the sharply rounded poles and a prominent lateral protrusion in the mid-region. L. 169—180; W. 91—99; T. 61—64; I. 23—25.

Cellulae magnae, 1.8—2.0 plo longiores quam latae; anguli basales acute rotundati et ad angulos semicellulae alterius obtendendos extensi, hoc modo sinum medium, profundum et interne ampliatum, claudentes; margines laterales late concavi, deinde in lobulos laterales superiores divergentes, his angustis et abrupte sursus directis; sinu profundo inter hos et lobum polarem late cuneatum; margo apicalis convexus, incisione polari angusta; superficies semicellulae protuberatione media surpaisthmali prominente, atque protuberatione intramarginali minore utrimque in basi semicellulae atque protuberatione humili media in parte lobulorum apicalium praedita; membrana grosse scrobiculate; semicellula a latere visa truncato-pyramidata, marginibus ad apicem amplificatum, trilobatum aequaliter convergentibus; semicellula a vertice visa ellipsoidea, protuberationem utroque in latere polorum acute rotundatorum, atque protrusionem lateralem prominentem media in parte praebens. Long. 169—190; lat. 91—99; crass. 61—64; isthm. 23—25.

Florida: Pond 3 miles south of Sopchoppy, Wakulla Co. (Fla. 154).

This variety differs from the typical mostly in the deeper and inwardly opening sinus between the polar lobe and the base of the semicell, and in the narrowness and sharpness of the basal angles. Also the Florida plants have no central mucilage pore nor the protuberances on either side of it which characterize the typical. It approaches some of the varieties of *E. crassum* (Bréb.) Kuetz., with which it should be compared.

Euastrum verrucosum Ehrbg. fa. Pl. II, Fig. 5.

In this form the polar lobe is more produced than in the typical because the upper lateral sinuses are deeper and narrower and hence the upper lateral lobules are relatively narrower and longer. L. 82; W. 68; I. 19.

Florida: Pond 22 miles southwest of Ocala, Marion Co. (Fla. 164).

Euastrum verrucosum var. *alatum* Wolle fa. EXTENSUM fa. nov. Pl. II, Fig. 6.

A form differing from the typical by having narrower basal lobules, which are longer and more nearly horizontally directed; the apical lobe broad, with the upper margin less retuse; granulations similar to the typical except that there are two prominent granules at the apex and a definite row of granules across the base of the semicell just above the isthmus. L. 85—87; W. 79—88; T. 42; I. 18.

Forma a varietate typica differens lobulis basalibus angustioribus, longioribus et potius horizontaliter extensis; lobus apicalis latus, margine superiore minus retuso; granulationes plantae typicae similes nisi quod habet duo granula intramarginalia prominentia in apice atque ordinem definitum granulorum trans basim semicellulse admodum supra isthmum. Long. 85—87; lat. 79—88; crass. 42; isthm. 18.

Florida: Swamp 9 miles southeast of Naples, Collier Co. (Fla. 80).

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EXPLANATION OF PLATES

PLATE I.

Figs. 1, 2. Euastrum fissum West & West var. decoratum var. nov.
3. E. fissum West & West var. pseudoelegans var. nov.
4. E. bidentatum Naeg. var. quadrioculatum var. nov.
5. E. Ciastonii Racib. var. apertisinuatum var. nov.
6. E. Ciastonii Racib. var. asymmetricum var. nov.
7. E. pingue Elfv.
8. E. invaginatum sp. nov.
9. E. Turneri var. stictum (Boerges.) nobis, comb. nov.
10. E. acmon West & West var. turgidum var. nov.
11. E. floridense sp. nov.
12. E. pectinatum Bréb. var. lobuliferum var. nov.
13. E. giganteum (Wood) Nordst.

PLATE II.

Fig. 1. Euastrum crassum (Bréb.) Kuetz.
2. E. ventricosum Lund. var. sopchoppiense var. nov.
3. E. crassum var. scrobiculatum Lund. fa.
4. E. insigne var. lobulatum Presc. & Scott fa. acutilobum fa. nov.
5. E. verrucosum Ehrbg. fa.
6. E. verrucosum var. alatum Wolle fa. extensum fa. nov.

PLATE III.

Fig. 1. Euastrum bidentatum var. oculatum (Istv.) Krieg. fa. glabrum fa. nov.
2. E. evolutum var. monticulosum (Tayl.) Krieg. fa. poriferum fa. nov.
3. E. evolutum var. reductum var. nov.
4, 5. E. evolutum var. integrius West & West fa. turgidum fa. nov.
6. E. Turneri W. West fa. poriferum fa. nov.
7. E. fissum West & West var. angustum var. nov.
8. E. informe Borge fa. oculatum fa. nov.
9. E. denticulatum var. rectangulare West & West fa.
10. E. hypochondrum Nordst. fa. decoratum fa. nov.
11. E. sphyroides Nordst. fa. granulatum fa. nov.
12. E. platycerum var. acutilobum Krieg. fa. dentiferum fa. nov.
13. E. hypochondrum Nordst. fa. prominens fa. nov.

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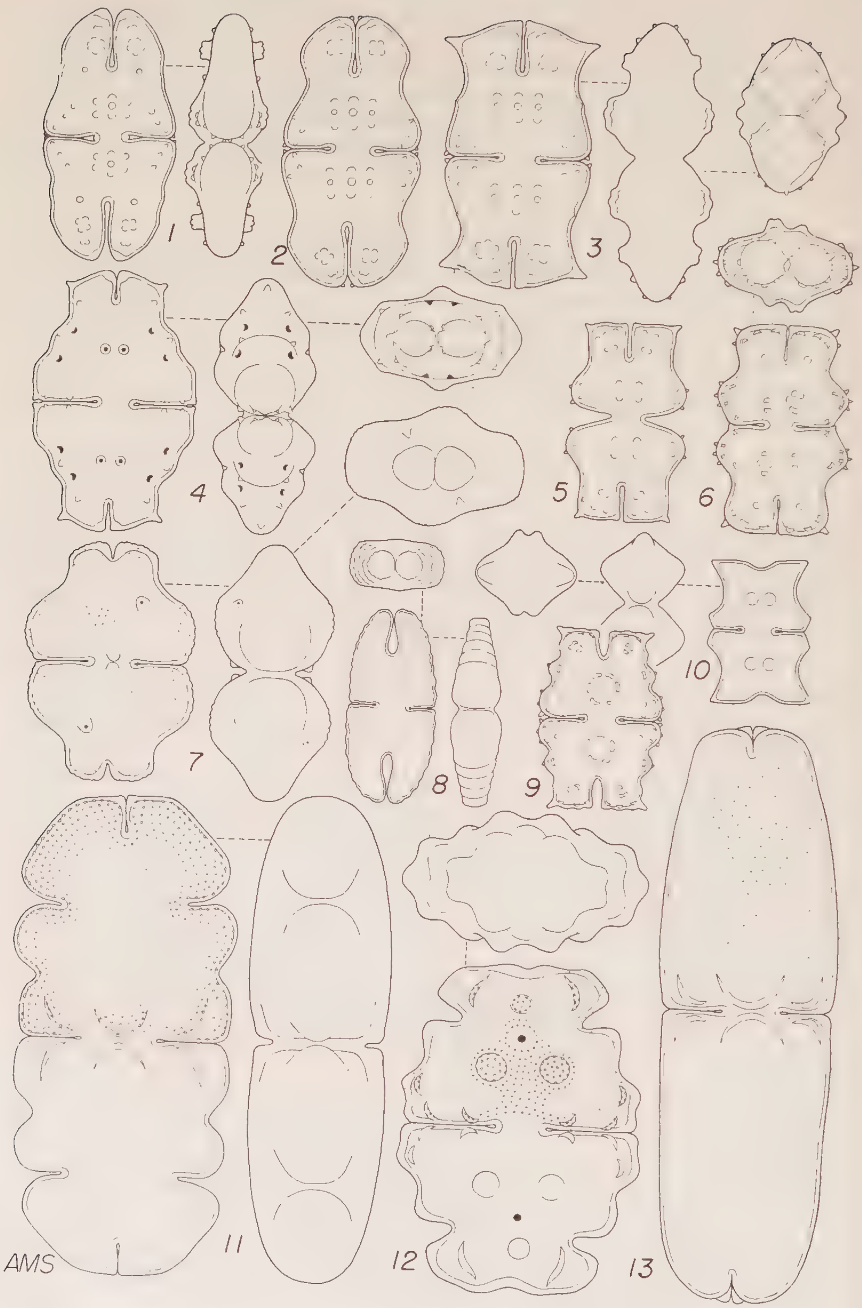
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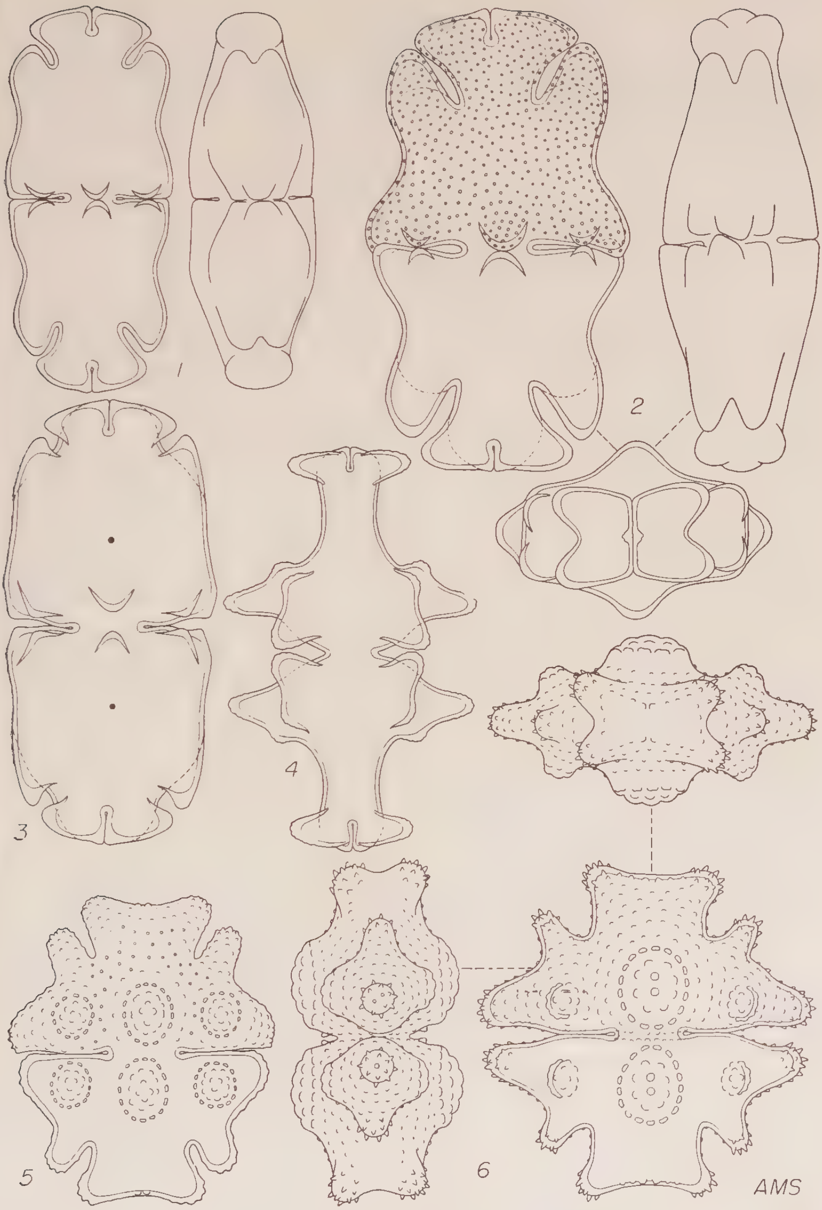

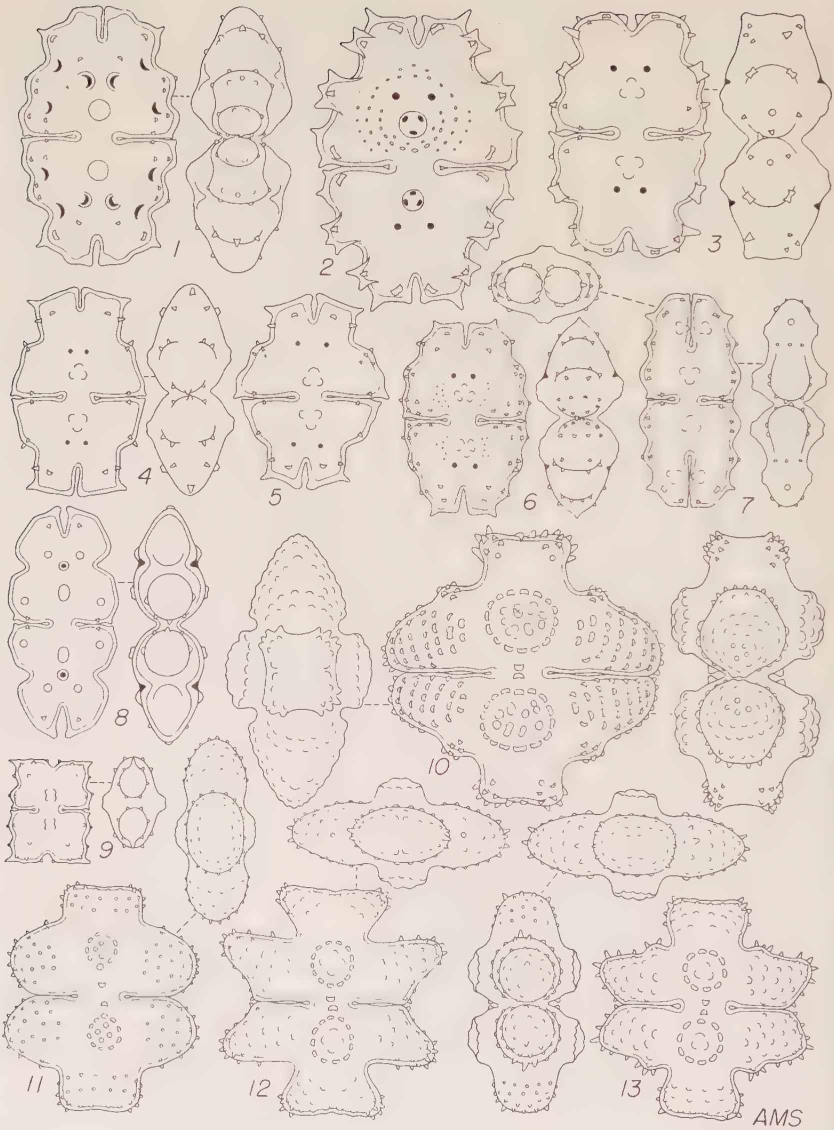
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On the nuclear cytology of Hydrodictyon

by

JOHANNES PROSKAUER

In the autumn of 1948 Dr. M. A. POCOCK suggested to me a cytological investigation of three members of the genus *Hydrodictyon*, on which she has been carrying out extensive studies.

In the literature on the genus there are a number of descriptions of nuclear phenomena. TIMBERLAKE (1901) gave a detailed account of nuclei and their division in *H. reticulatum*. Because of the small size of the chromosomes he was unable to achieve an accurate count, but mentioned that, in a few instances, he could discern ten. He also noted certain apparent anomalies. YAMANOUCHI (1913) furnished a description of mitosis in his *H. africanum*, where he counted eighteen chromosomes. My observations on mitosis confirm and broaden the general conclusions of these workers, but no centrosomes or spindle fibres were seen, and the splitting of the spindle at anaphase figured by YAMANOUCHI appears to lack basis in fact. As TIMBERLAKE had already concluded, mitosis in these organisms is essentially 'normal'. TIMBERLAKE's and YAMANOUCHI's papers show that good information on nuclear phenomena in algae is not just a development of recent years.

MAINX (1931) noted in passing that he had observed typical meiotic synapses in germinating zygospores of *H. reticulatum*. He concluded that the species was a typical haplont, as shown below on somewhat more ample evidence.

The paper by PALIK (1949) on *H. reticulatum*, therefore, came as a considerable surprise. So-called division of large stellate 'nuclei' was described at length, and he concluded that the process was markedly different from normal mitosis, and unlike anything before, seen in plants. In addition meiosis was stated to take place during gametogenesis, the haploid chromosome complement being two. Examination of his many photographs makes it evident that the large stellate bodies, the division of which was described, were not nuclei. Where the former are shown, the latter do not appear to have stained. The most probable explanation is that the stellate bodies represent

localized fixative or other mineral precipitates. Unfortunately it is not indicated which one of several described techniques was employed in the preparation of particular specimens.

The description of meiosis, however, was based on observations on real nuclei as shown by the illustrations, but these nuclei appear to have been undergoing normal mitosis. The chromosome counts were apparently obtained from early anaphases seen in side view, a whole chromosome plate seen edgewise being interpreted as one or two chromosomes respectively. This seems to explain the enucleate cells with postulated nuclear migration into them, and numerous other aberrant phenomena described in the paper.

The following observations are put on record to reemphasize the essentially normal character of the nuclear behaviour. All the described species of *Hydrodictyon*, with the exception of the *H. indicum* of IYENGAR, which is of uncertain standing (cf. POCOCK, 1937), were available for study and proved uniform in matters of detail.

MATERIALS

The material, with one exception, was collected by Dr. POCOCK, whose efforts made this paper possible. My thanks are due to her also for reading the manuscript. The species examined were:

Hydrodictyon reticulatum (L.) LAGERHEIM (syn. *H. utriculatum* ROTH).

(1) Recreation Grounds, Fremont, Nebraska, U.S.A. In rainwater pools.

(2) Cherry Creek, Nevada County, California, U.S.A. Collected by Dr. MALCOLM NOBS.

Cultures of nets and zygospores were kindly supplied by Dr. POCOCK. The nets were cultured in a solution prepared according to the recipe given by JULLER (1937), with added soil extract. Zygospore cultures were obtained by plating out gametes in drops on the surface of agar plates containing the same minerals (3/4 % agar made up in the same culture solution).

Hydrodictyon patenaeforme POCOCK.

(1) Grahamstown, Cape Province, South Africa.

(2) De Klip, Cape Flats, near Cape Town, South Africa. (Type area).

Cultured from soil samples by Dr. POCOCK.

Hydrodictyon africanum YAMANOUCHI.

Isoetes vlei, Cape Flats, near Cape Town, South Africa. (Type area)

The plants appeared in a culture from a soil sample supplied by Dr. POCOCK. This series of cultures was initially made for the purpose of growing *Riella purpureospora;* in addition *Nitella praeclara* and *Isoëtes* sp. were present.

METHODS

The material was fixed in one part ethanoic acid to three parts of ethanol throughout.

(a) Mitosis — Whole mounts. Stained either (a) with Harris' haematoxylin with cytoplasmic counterstain of orange G, phloxine or fast green, or (b) with acetocarmine (see below), with or without cytoplasmic counterstain.

(b) Mitosis — Squashes. Late in the afternoon or early in the morning some cells of a healthy growing net generally showed division. Parts of such nets were fixed and stained by the acetocarmine method described by GODWARD (1948). This involves short washing in water, mordanting up to a minute in 4 % aqueous ferric ammonium alum, short washing in water, followed by staining for a few minutes in saturated acetocarmine. It was found efficacious to open up some of the larger coenocytes after fixation, the material being then mounted in acetocarmine and slightly warmed. This cleared the cytoplasm and tended to decolourize the pyrenoids and to bring out the nuclei and division stages. Any coenocyte showing division was now easily recognised. If large enough, it was cut open with fine scissors, and the protoplast removed with fine needles. It also proved satisfactory merely to cut up the coenocyte into small pieces convisting of wall material with adhering protoplasm. The pieces were remounted in acetocarmine, or, if some destaining was desirable, in 45 % ethanoic acid. The heated preparation was placed on a table and the coverslip pressed down sharply with a cloth-covered finger. The protoplasm tended to spread on the coverslip. The preparations were studied at this stage. They could be made permanent by inverting the slides in dilute ethanoic acid, when the coverslip, with the adhering protoplasm, drops off; after dehydrating the preparation is mounted in 'Diaphane' ('Euparal').

(c) Meiosis. Agar cultures of green zygospores in active growth were employed, i.e. cultures in which the zygospores had not entered the resting phase characterized by production of orange pigment. The agar with the spores on its surface was cut into small blocks which were transferred to 'Pyrex' glass dishes containing 50 % culture

solution or merely glass-distilled water. After one or two days the first zoospores and polyhedra appeared in the solution. When germination was in progress, the blocks were fixed and stained *in toto* by the acetocarmine method described above. The excess agar was trimmed off, and the rest of the block mounted on a slide in acetocarmine. Warming dissolved the agar, leaving the zygospores. Those which had not started to germinate tended to retain some pigment and stained tardily, but repeated heating proved helpful. Changes in the spore membranes during germination allowed better diffusion. The nuclear details were seen more clearly when the preparation was squashed. This liberated the contents from the spore wall and spread them out (fig. 23).

OBSERVATIONS

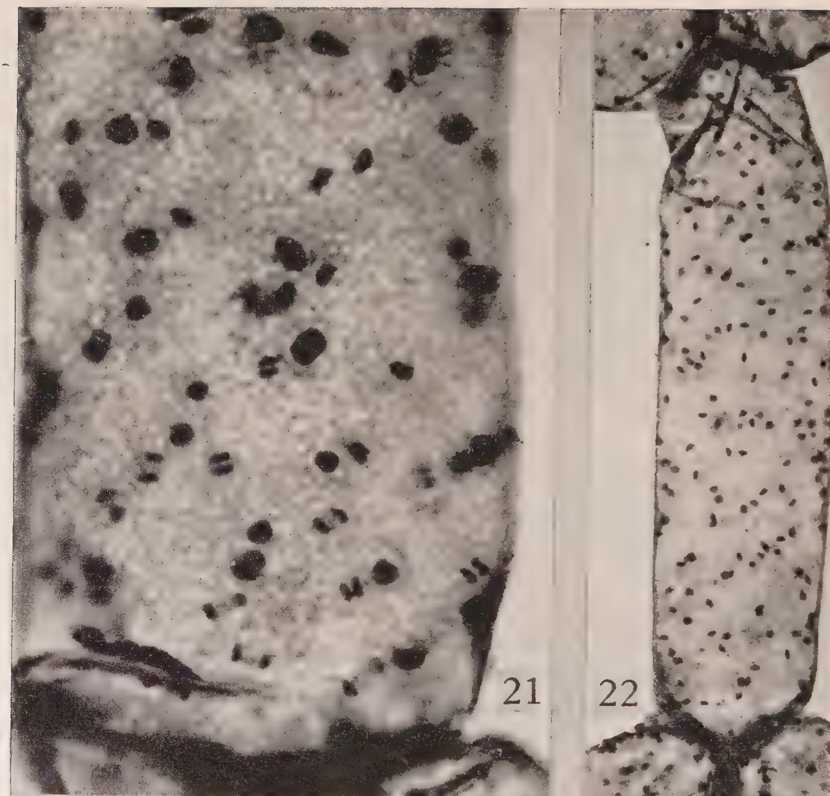
Young cells of nets of all the species of *Hydrodictyon* under review start with the single nucleus of the parent spore, and possess one pyrenoid. Nuclei and pyrenoids increase in number as the cells enlarge. I do not desire to enter into the controversy about the chloroplast, except to state that I have been unable to convince myself of its existence as a distinct entity in the older coenocytes. The structure of the mature protoplast appears indistinguishable from that of *Protosiphon*, if a comparable portion of the vesicle of that organism is considered. It also shows some resemblance, albeit somewhat remote, to that of certain species of *Cladophora*.

Nuclear division proceeds independently in different cells of a net; within individual cells there is, however, some synchronization. In smaller coenocytes all the nuclei will be in the same phase of mitosis at the same time; in Fig. 22 all are at metaphase of division. In larger coenocytes nuclear division spreads like a wave. Thus, nuclei at the (variable) point at which division started may be at telophase. These will be surrounded by a belt of anaphases, these in turn by metaphases, prophases, and interphases respectively. Fig. 21 illustrates the range from metaphase to late anaphase in one of the smallest coenocytes in which such division was observed. Ultimately, in large coenocytes, the number of nuclei can generally be estimated to be of the order of tens of thousands, while in *H. patenaeforme* Pocock (1937) estimated it at hundreds of thousands prior to gametogenesis. In such cells some thousand or so nuclei can be found in the same mitotic phase. *Hydrodictyon* may well be suitable for studies on certain aspects of the physiology of mitosis.

The following description of mitosis is based on unsquashed whole mount preparations of *H. reticulatum*, but the details have

been found to be identical in the other two species. The interphase (figs. 1, 10) contains a single central nucleolus; the nucleoplasm appears slightly granular and no definite heterochromatin is observable. In early prophase chromocentres appear in the nucleoplasm (fig. 2). As the chromosomes become recognisable the nucleolus disappears (figs. 3—5). In metaphase the chromosomes form a dense plate. At this stage the spindle is somewhat difficult to demonstrate (figs. 6, 21). Since its axis normally lies parallel to the cell wall, the chromosome plate is seen edge-on in whole mounts and, as the chromosomes are very small and compacted, the plate appears under medium magnification as a thick short line (figs. 21, 22), although under higher magnification individual chromosomes can be distinguished (figs. 24, 28 from squashes). At anaphase the spindle is

Figs. 1—12, 17—20, *Hydrodictyon reticulatum;* 13—14, *H. patenaeforme:* 15—16, *H. africanum* Figs. 1—10, Stages of mitosis from whole mount preparations. Figs. 11—16, Metaphase plates, squashes. Figs. 17—20, Meiosis, squashes of germinating zygospores, fig. 17, probably pachytene, the rest metaphase. × 2400.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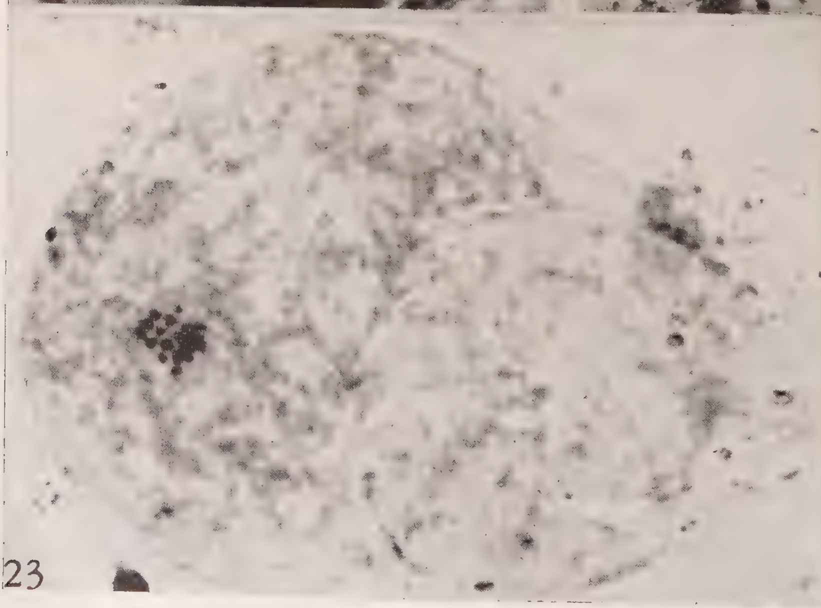
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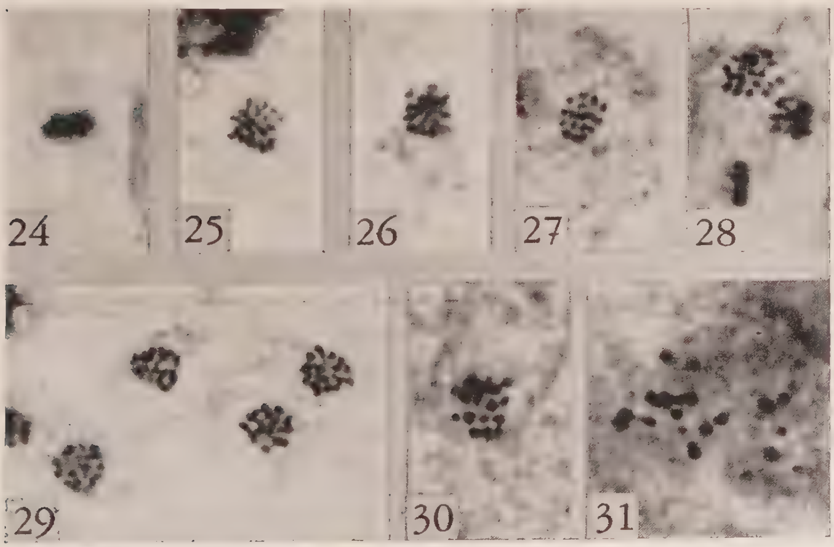
quite clear (figs. 7, 8, 21), especially between the separating chromosomes. It is, presumably, gelatinous in nature. The ultimate distance of separation is variable. Reorganization at telophase (fig. 9) is difficult to decipher. The sister nuclei (fig. 10) continue to lie close together for some time.

The largest chromosomes do not exceed one micron. In squash preparations the plates flatten out somewhat, but spreading of chromosomes is very limited. The appearance of the plates and chromosomes is identical in all the material of the three species studied, and their number also appears the same. It was impossible to count them with absolute certainty, even with the numerous stages provided by large coenocytes. The number appears to be 19 ± 1, but most likely 19 or 18. The uncertainty is due to the small size and the possibility of the presence of satellites. Metaphase plate squashes are illustrated for *H. reticulatum* in figs. 11, 12, 25, 26,



Figs. 24—26, 30, 31, *H. reticulatum;* 27—28, *H. patenaeforme;* 29, *H. africanum.* Figs. 24, 28, Mitotic metaphase plates in side view. Figs. 25—29, Mitotic metaphase plates. Figs. 30—31, Meiotic metaphases. All from squashes × 2000. (Zeiss Apo. 60 I, 40; Homal iv).

Figs. 21—23. *H. reticulatum.* Fig. 21, Divisions in a small coenocyte; metaphases above, anaphases below. × 1000. Fig. 22, Small coenocyte, all the nuclei are at metaphase (the plates appearing as short lines); the round objects are pyrenoids. × 345. Fig. 23, Squash preparation of germinating zygospore at meiotic metaphase; note the broken zygospore membrane. × 2000.

for *H. patenaeforme* in figs. 13, 14, 27, 28, and for *H. africanum* in figs. 15, 16, 29.

Meiosis could take place in the life cycle of *Hydrodictyon* during the germination of the zygospore or at gametogenesis. The latter possibility is attractive in so far as reduction there might account for the difference in behaviour of zoospores and gametes. No evidence was found to support it. On the other hand, stages of the first nuclear division in the germinating zygospore, the 'orthodox' place, have the aspect of meiotic figures recognised in other plants. Only one nucleolus is generally present in the zygospore nucleus. Detail of prophase stages is, as is common, hard to discern clearly. Fig. 17 shows what is believed to be pachytene. At diakinesis and metaphase the gemini appear considerably larger than the ordinary mitotic chromosomes. In fresh preparations their component chromosomes could sometimes be distinguished. No more than 18 or possibly 19 gemini were observed in any instance, but this does not preclude the possibility that a twentieth may have been hidden somewhere (figs. 18—20, 30, 31). More than two dozen meiotic metaphases were studied.

In the second division within the zygospore, where observed, the chromosomes are of the same size as the ordinary somatic ones. Observations on the fixed preparations suggest that often only two zoospores are formed. There was some vague indication of breakdown of supernumerary nuclei. It remains an open question whether the gametes can also develop parthenogenetically. More work on late stages of germination on living material is needed. Micromanipulation may probably prove to be the most suitable method for investigating the possibility of parthenogenesis.

The observations on meiosis were made on material of *H. reticulatum* only, but it is presumed that the other species show an identical behaviour.

In view of the statements of previous workers, the following abnormality may be mentioned. In the beginning of these studies an attempt was made to induce mitosis by putting cultures of nets into dark electric ovens at slightly elevated temperatures, although this method was not used in any of the work described above. One net of *H. patenaeforme* was placed in an oven at the set temperature of 30° C, but, owing to bad ventilation, the temperature may have risen to somewhat above that figure. In certain cells of this net nuclear divisions with tripolar spindles were observed; those cells which were not fixed were moribund, and died shortly after the exposure. The same phenomenon might occur in nature, where similar temperatures may be reached when a pool dries up. It may explain TIMBERLAKE's tripolar spindles and large irregular nuclei,

as opposed to the large 'nuclei' of PALIK, and may normally occur during the frequently observed death of large populations without reproduction. In squash preparations of normal material a few nuclei with apparently double the normal chromosome complement have been seen. These cases have been interpreted as resulting from squashes of early anaphases, rather than metaphases of diploid nuclei.

SUMMARY

1) Mitosis was studied in *Hydrodictyon reticulatum*, *H. patenaeforme*, and *H. africanum;* whole mounts and squash preparations being employed. The process is similar to that found in other plants. Division is synchronized, in larger coenocytes it proceeds in wave-form. The behaviour of the different species is identical.

2) Meiosis was observed in germinating zygospores of *H. reticulatum*.

3) The chromosome number is identical in all the species. The number was determined within the limits 19 ± 1.

4) Elevation of temperature above 30° C induced abnormal tripolar nuclear divisions, followed by death.

ZUSAMMENFASSUNG

1) Die Mitose bei *Hydrodictyon reticulatum*, *H. patenaeforme* und *H. africanum* wurde untersucht, unter Benutzung von Ganz- und Quetschpräparaten. Die Vorgänge weichen von denen in anderen Pflanzen nicht ab. Kernteilung erfolgt synchron (wellenförmig in grösseren Zellen). Die untersuchten Arten verhalten sich vollkommen gleich.

2) Die Reifeteilung wurde bei der Zygotenkeimung von *H. reticulatum* festgestellt.

3) Alle Arten haben die selbe Anzahl von Chromosomen, sie fällt in die Grenzen 19 ± 1.

4) Erhöhung der Temperatur über 30° brachte abnorme tripolare Kernteilungen und darauffolgendes Absterben herbei.

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Vol. IV Nr. 4

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